Investigating teachers' perception about the educational benefits of Web 2.0 personal learning environments

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Implementing personal learning environments (PLEs) in educational settings is a challenging and complex process. Teachers as the main agents of change in their classroom settings need support in designing and implementing these new learning environments and integrating them into the educational process. In this paper, we propose a model to implement Web 2.0 PLEs in educational settings based on the conceived objectives of PLEs, namely (i) enhancing the students' control in educational process and (ii) supporting and empowering students to build and deploy their PLEs. In addition, we develop a technological prototype based on the model, and report and analyze the perceptions of a group of teachers regarding the potential of the prototype to improve the educational process. The results suggest that the implementation of the model can contribute to the development of a student-centric learning environment and improvement in the teachers' technological, pedagogical, and content knowledge (TPACK).

Tags

PLE, Web 2.0, design-based research, student's control, eLearning 2.0, TPACK

1. Introduction

In recent years, the concept of personal learning environments (PLEs) has attracted the attention of researchers and practitioners in the educational technology domain. Attwell (2007b) says:

> *Important concepts in PLEs include the integration of both formal and informal learning episodes into a single experience, the use of social networks that can cross institutional boundaries and the use of networking protocols (Peer-to-Peer, web services, syndication) to connect a range of resources and systems within a personally-managed space.*

The main feature of PLEs that distinguishes them from other sorts of technology-based learning initiatives lies in their emphasis on the role of students as the manager and developer of their learning environments. In this regard, Attwell (2007a) defines Web 2.0 PLEs as activity spaces, consisting of loosely coupled Web 2.0 tools and learning resources collected by students to interact and communicate with each other and experts in order to address their heterogeneous learning requirements, the ultimate result of which is the development of collective learning. Along similar lines, Drexler (2010) and Väljataga & Laanpere (2010) define the development of PLEs as a student-driven learning process and an important learning outcome constructed by students.

Implementing the PLE concept in educational settings is a complex process that consists of several challenges. Firstly, it requires redefining the commonly accepted roles of teachers and students in the educational settings. The traditional procedures of teaching assume students as not sufficiently knowledgeable individuals to take full control over their learning.

This assumption strengthens the role of teacher as the main controller of the educational practices with the main goal of transferring predefined content to the students (Dron, 2006) resulting in too much teacher control in the educational process and leading to poorly tailored learning experiences, student boredom and demotivation (Garrison & Baynton, 1987). Residing too much control with the teacher can diminish mutual communication as well as opportunities for students to construct meaning and knowledge. It is in stark contrast to the conceived objective of PLEs, which is to transfer control of learning from teacher to students (Attwell, 2007a; Buchem, 2012). Secondly, generally speaking, teachers, as the main agents of change in their classrooms, are resistant to adopt technological and pedagogical innovations (Ertmer & Ottenbreit-Leftwich, 2010). Hope (1997) wrote, teachers basically have to contend with two factors with technology adoption: (i) the psychological effect of change and (ii) learning to use technology. Nonetheless, the PLE concept has introduced the third challenging factor to teachers: rethinking their pedagogical approach to facilitate more student control in the educational process using Web 2.0 tools and technologies. Thirdly, beyond some technologically oriented approaches, there are not clear references and well-established pedagogical models of PLE-based teaching and learning, and practical advice to support it available. In this regard, as asserted by Fiedler & Valjataga (2011), while there is an intense focus on issues of re-instrumentation of teaching and learning practices in the PLE literature, enhancing students' control as the main objective of PLE remains largely untouched and ignored. Therefore, teachers do not have a clear perception of the PLE concept, and its technological and pedagogical implications and benefits, which makes them hesitant to accept and adopt the concept.

Research has shown that new technology or pedagogy adoption decisions are mainly influenced by teachers' individual attitudes towards the technology or pedagogy, which in turn are formed from specific underlying personal beliefs about the consequences of the adoption (Sugar et al., 2004; Ma & Harmon, 2009). Therefore, they must be personally convinced of the feasibility and benefits of the new technology or pedagogy before adoption and integration occur (Lam, 2000). Research has suggested that one of the best ways to convince and motivate teachers to adopt a new technology or pedagogy is by providing opportunities for them to witness and perceive the benefits of these changes. In this regard, Ertmer & Ottenbreit-Leftwich (2010) asserted that observing examples and models of a technology integration or a pedagogical approach by teachers can increase their knowledge, change their belief system, and convince them to adopt the new technology or pedagogy by helping them to understand what the approach or tool looks like in practice and to make a judgment about whether that approach or tool (i) is relevant to their goals, (ii) enables them to meet student needs, and (iii) addresses important learning outcomes.

In this paper, we seek to develop a model to support building and deploying PLEs and to investigate teachers' perceptions regarding the impact of PLEs on improving educational practices. In this regard, first we develop a pedagogically oriented model for PLE-based teaching and learning. Then we build a technological prototype based on this model to be used as an example for introducing and presenting the PLE concept. Afterwards, in order to examine how the prototype can contribute to improving the educational practices, we report the results of the conducted interviews with a group of teachers in the context of a secondary school. Finally, we propose design principles and guidelines to improve the next version of the prototype.

2. Research Methodology

In order to develop a model to support building and deploying PLEs, an approach using design-based research for one iteration was used, comprising four broad phases, as illustrated in Figure 1 (Ma & Harmon, 2009). Design-based research focuses simultaneously on practice and theory through finding and solving practical problems and providing design principles. To do so, it starts with (i) identifying and analyzing a complex real world educational problem in the research context and (ii) generating a solution based on reviewing existing theories and consulting with practitioners, (iii) evaluating the solution by gathering empirical data, and (iv) reflecting on the design experience to refine the solution and construct theoretical knowledge (Reeves et al., 2005).

3. Analysis of a practical problem

The context of this research is a secondary school. Seeking ways to take advantage of the PLE concept, Web 2.0 tools and social software to enrich teaching and learning processes, and to improve pedagogical and technological competencies of teachers and students are the main drivers for this school. Following design-based research, we started our research by identifying a problem within this context.

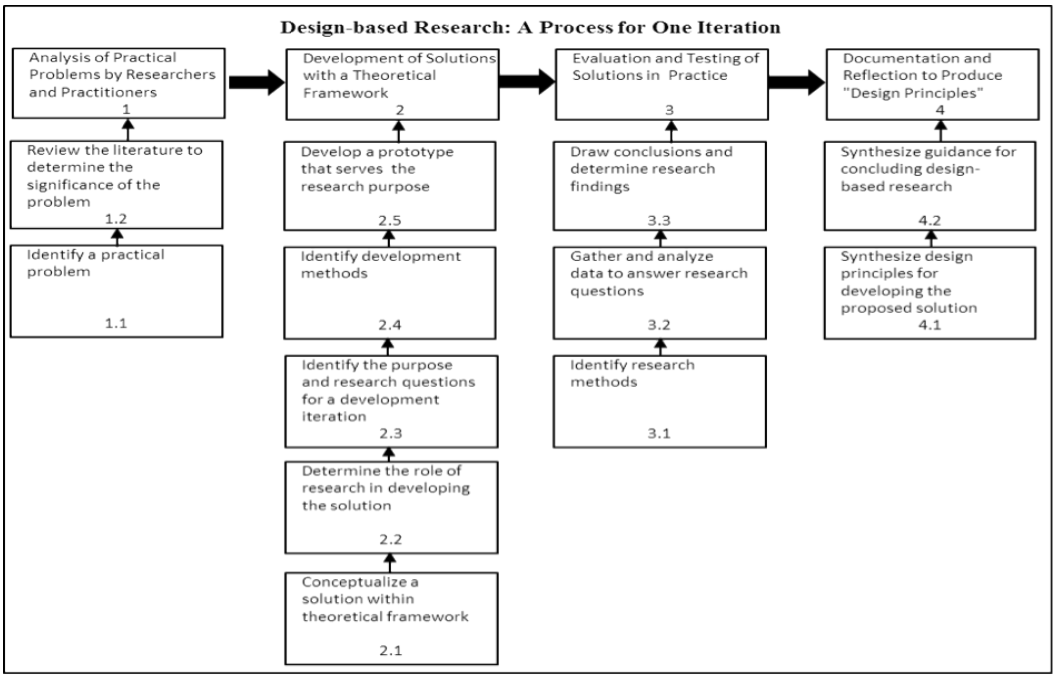

Figure1. Design-based research: A process for one iteration (Ma & Harmon, 2009)

3.1 Identify a problem

Although the school's teachers have been trying to adopt a PLE-based pedagogical approach, there was not a model available to support teachers and students to develop and deploy their PLEs. As a result, the teachers did not have a clear conception and understanding of the PLE concept and its benefits and implications for their educational practices, which affected their willingness to adopt and apply this concept in their classrooms.

3.2 Determine the significance of the problem

In the e-learning domain, PLEs are increasingly attracting the attention of educational researchers and practitioners as an effective pedagogical approach to addressing issues of personalization and student's control. A problem with supporting the conceived objectives of PLEs has been that, while there are a large and increasing number of suitable Web 2.0 tools and learning resources, a comprehensive pedagogical and technological framework as well as practical advice on how to construct Web 2.0 PLEs is unavailable. Affected by this gap, educators at different educational levels are forced to adapt and rethink their teaching approaches in conjunction with the advent of new Web 2.0 PLEs without having a clear perception of PLEs and a roadmap for attending to students' various needs (Kop, 2008; Fiedler & Valjataga, 2011).

4. Development of a solution with a theoretical framework

To address the identified problem we decided to develop a pedagogical model and technological prototype based on this model. There are two main conceived objectives of PLEs that can be used to outline a model for developing and deploying PLEs in educational settings, being (i) enhancing the students' control in the educational process, and (ii) supporting and empowering students to design and develop their PLEs (Attwell, 2007a; Johnson & Liber, 2008; Drexler, 2010; Valtonen et al. 2012). To support these objectives, several learning theories and principles should be involved in order to define the main components of the model and their interactions.

Student control in the educational process is concerned with the degree to which the student can influence and direct their learning experiences and it relates to several aspects of the educational process (Garrison & Baynton, 1987). Firstly, the theory of transactional control (Dron, 2007) suggests that control is concerned with choices. Based on this theory, an indicator for a "mature learner" is her ability for making relevant and effective choices in her learning journey. Hence, providing students with proper technological, pedagogical, and social choices to define their learning aims and methods is a prerequisite step for them to achieve control over their learning by moving from a "state of dependence to one of independence", and has the potential

to enhance the student's feeling of ownership and control. According to Buchem et al. (2011), there are different sorts of choices for students in PLEs including technological choices (i.e. learning tools), pedagogical choices (i.e. learning objectives, learning content, learning rules and, learning tasks), and social choices (i.e. learning community).

Secondly, developing and applying PLEs requires flexible pedagogical approaches and technological activity spaces to allow students to construct and manipulate their learning environments by defining their learning goals, choosing tools, joining or starting communities, and assembling resources (Attwell, 2007a). Providing flexibility in pedagogical approaches or technological aspects has the potential to improve students' control over their learning process. As asserted by Buchem (2012) there is a strong relationship between students' control and their feeling of ownership over learning with (perceived) possibilities to manipulate their learning environments.

Thirdly, according to Johnson & Liber (2008), any attempt for developing PLEs should focus on the personal development of students as an inherent aspect of PLEs. Reflection has been asserted as the core source of personal development (Schon, 1983) by enhancing the effectiveness of learning and promoting metacognition, learning to learn and self-regulation (Verpoorten et al., 2012). Accordingly, any model that aims to support the development of PLEs should provide opportunities and triggers for students to reflect on their learning practices. Contextual information on the learning process has been proven to support the students' reflection by stimulating the students' engagement in a collaborative process, raising their awareness about the learning environment and triggering their reflection about acquired competences (Glahn et al., 2007). In a PLE-based learning scenario, an important part of contextual information encompasses past or current activities or events occurred in the learning environment through deploying web tools by the students. Collecting and presenting these information can provide possibilities for students to observe each other's learning behavior, reflect on their learning process and progress by comparing aspects of their learning experience with other students, and collaborate with peers by sharing and receiving material and providing feedback (Verpoorten et al., 2012; Valtonen et al., 2012).

Fourthly, according to Johnson & Sherlock (2012), there is a bidirectional and feedback relationship between the learning environment and the student's personal agency in such a way that the things that students do are transformative of the environment within which they operate, and vice versa. According to Rahimi et al. (2013a), in PLE-based learning both teachers and students should be assumed as learners. Indeed, the teachers in order to improve their teaching practices have an unceasing need to learn how to teach with technology, while the students need to learn how to learn by managing technology. From this perspective, the teacher and students are partners in the educational process (Clayson & Haley, 2005) and as noted by Ho (2003, p. 51), " teaching is not the art of filling the student with knowledge in the way one would fill and empty receptacle. Teaching is a two-way learning process in which the student and teacher help each other to learn by sharing their insights and difficulties with each other." From the PLE perspective, it can be argued that any attempt for enhancing student's control should recognize and corroborate the role of students in this feedback mechanism.

Figure 2 depicts the proposed implementation of the model, built upon the mentioned learning theories and principles. The model consists of two main parts, namely parts A and B, to address the two above-mentioned objectives of PLEs, respectively. Part A aims to enhance students' control in the educational process. Derived from the mentioned learning principles, this part has four main components, being (i) choices, (ii) personal activity spaces, (iii) aggregated information, and (iv) feedback system. The teacher seeds the learning environment by providing appropriate technological, pedagogical, and social choices. The students can access and use these choices in their personal activity spaces to perform learning activities and support their learning requirements. Appropriate information pertaining to these learning activities then can be aggregated to be used to support reflection and collaboration among the students. The feedback system aims to encourage the students to discover and introduce the learning affordances of the provided choices and other sorts of learning resources based on the ways that they perceive and operationalise them in their learning process. The teacher can use this insight for reseeding and reshaping the learning environment.

Part B illustrates how the model supports students to design and develop their PLEs. The model follows an iterative end-user development (EUD) approach (Fischer & Scharff, 1998) for designing and building PLEs. The EUD concept was originally developed in the field of computer science and human-computer interaction aiming at allowing and empowering end users of software applications as "owners of problems" to act

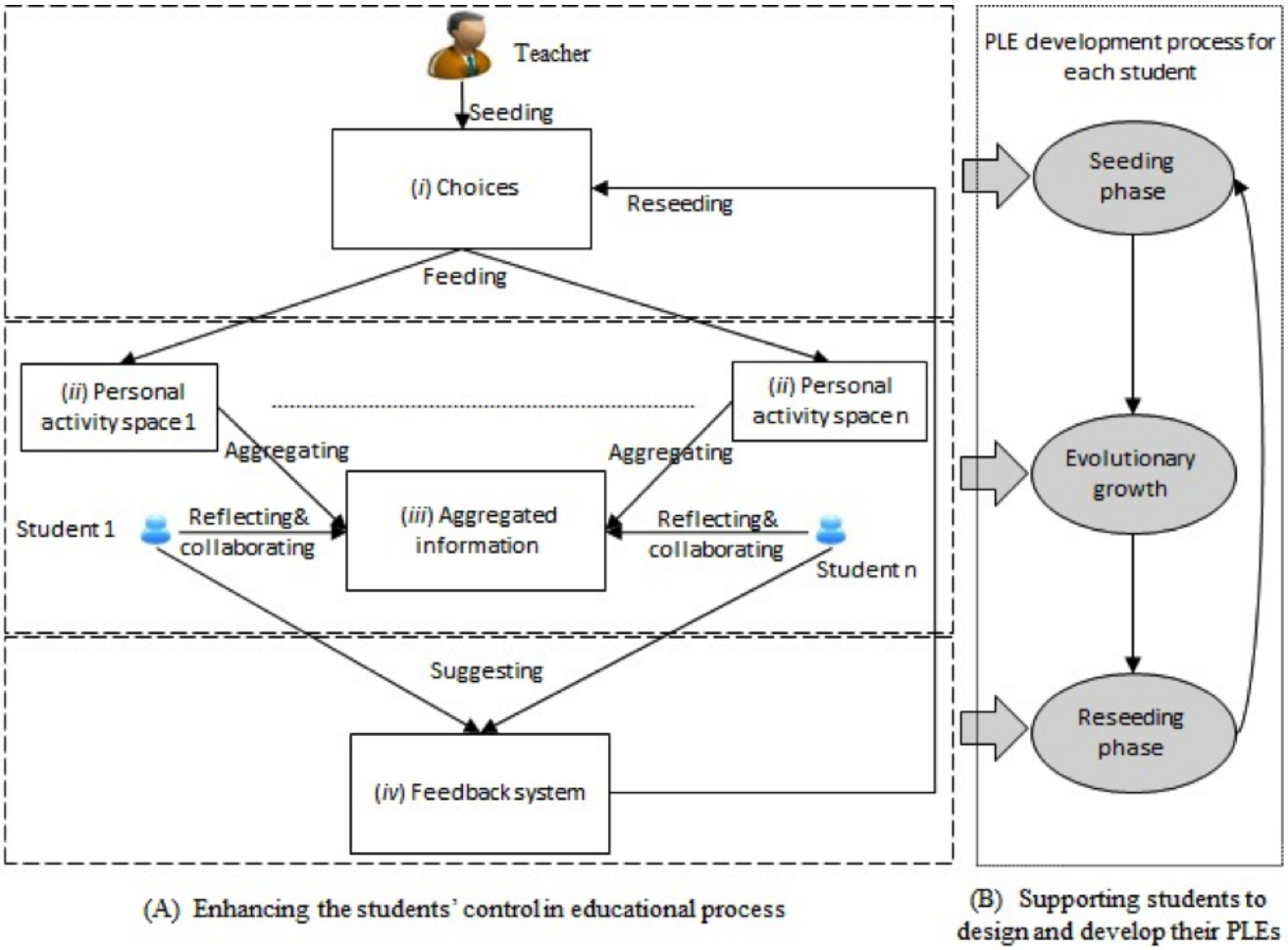

Figure 2. The proposed model consists of two parts to support the main objectives of PLEs

as designers to engage actively in the continuous development of their environments. Fischer & Scharff (1998) introduced the *seeding, evolutionary growth*, and *reseeding* (SER) process model to operationalize this concept by encouraging designers to conceptualize their activity as meta-design, thereby supporting end users as the developers of their environment rather than restricting them the role of to passive consumers. From this perspective, a PLE can be envisioned as a learning environment seeded by the teacher, *as designer*, with an initial set of relevant technological, pedagogical, and social choices (*seeding phase*). Then it is flourished and evolved by adding new learning resources through active participation of the teacher and students as a community of learners (*evolutionary growth*). The PLE will be reseeded through the feedback mechanism in order to add new choices or remove the current choices (*reseeding phase*).

4.1 Determine the role of research in developing the solution

The role of this research is to develop a first-iteration design of a model for constructing PLEs.

4.2 Identify the purpose and research questions for a development iteration

The purpose of this research is to implement a technological prototype based on the model and then to examine the perceptions of teachers about the potential of the prototype to improve the educational process. The following research question guides the research:

> *How do teachers perceive the PLE prototype as a means to improve the educational process?*

4.3 Identify development methods

Several issues pertaining to the implementation of the prototype need to be addressed, including (i) choosing an appropriate technological platform, (ii) identifying the tools to develop the prototype, (iii) providing technological choices to seed the prototype, (iv) determining the specifications of the PLE interface and, (v) supporting the reseeding phase.

Recent advances in computing, multimedia, communication, and web technologies have provided unprecedented opportunities for the educational institutions and learners to pursue and enrich their teaching and learning activities. Taking advantage of these advances, cloud computing is becoming a main paradigm in addressing the requirements of the web-based teaching and learning initiatives. Cloud computing supports SaaS architecture (i.e. the capabilities of software applications are exposed as services) and provides reliable, assured, and flexible service delivery while keeping the users isolated from the underlying infrastructure. As a result, "cloud computing makes it possible for almost anyone to deploy tools that can scale on demand to serve as many users as desired" without bickering about technical expertise and maintenance issues (Al-Zoube, 2009).

Google apps for education[1] is an appropriate cloud-based platform providing numerous technological possibilities for developing the prototype. It allows students to access thousands of available gadgets or build their own to fulfill their heterogeneous learning needs and provides several possibilities to support online collaboration and social learning. For instance, Google Docs and Spreadsheets allow the creation of documents and spreadsheets with more collaborative capacity and enable students to communicate around content. Also, Google Calendar lets students and teachers to set their personal or class-wide learning goals, plan the educational events, and monitor their learning process. Moreover, Google sites allows student to create their own private or public websites to publish and present their thoughts and findings.

The interface of the PLE prototype for each student can be divided into two parts: a personal part and a social hub. The personal part provides the student's access to a gadget container comprising of thousands gadgets. The student has full control over her personal part and can use it as an activity space to support her learning purposes by accessing, using, adding, customizing, sharing or removing gadgets. The social hub is a shared place between all PLEs where the information pertaining to students' activities and experiences in different tools is aggregated using aggregation software and presented to be used as a source of reflection and collaboration. It also contains a set of common tools seeded by the teachers to support the main educational processes of the school, namely orientation, execution and evaluation processes.

Google sites supports developing a specific type of start page consisting of two parts including public and private parts, accessible via a unique URL. The public part is manageable by the admin of the page and is visible for all of the allowed users, while the private part is visible and manageable only by the users. These functionalities define the start page as an appropriate option to build the PLE interface by using the public part of the start page to develop the social hub of the PLE interface and the private part for the personal part of the PLE interface.

To support the reseeding phase, the functionalities of Google spreadsheets and Google sites, along with HTML, can be used to implement a feedback mechanism. This mechanism allows the students to introduce and share their preferred web tools and learning resources based on a defined structure, explain the learning benefits and affordances of tools, and rate them based on some defined criteria such as perceived ease of use or learning usefulness.

4.4 Develop a prototype that serves the research purpose

After having identified and chosen the development methods, the next step was to implement the prototype. Figure 3 shows the PLE interface for each student consisting of a social hub and a personal part.

The social hub provides the following functionalities:

- Seeding the PLE with appropriate choices in terms of web tools, useful links and relevant people
- Providing links to the students and teachers' websites and blogs
- Presenting teacher's announcements
- Aggregating the information pertains to learning activities and experiences of students accomplished in different tools by using a feed aggregation software (i.e. FriendFeed[2])
- Managing class-wide activities by using a calendar widget

[1] http://www.google.com/enterprise/apps/education/

[2] http://www.friendfeed.com

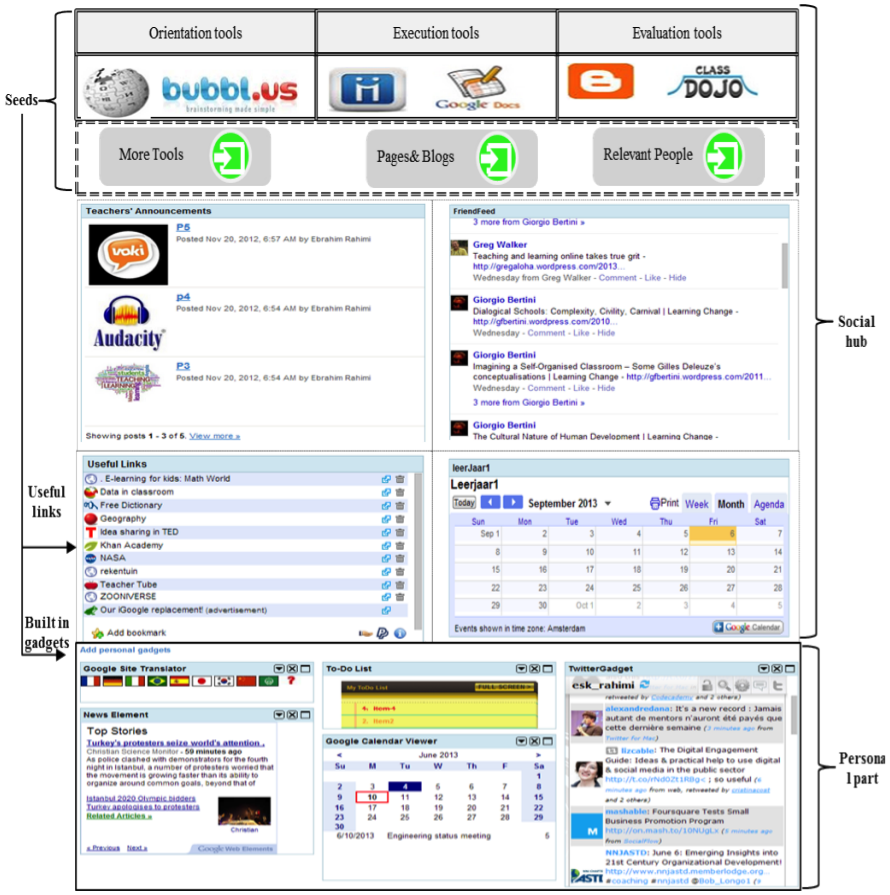

Figure 3. The interface of PLE for each student

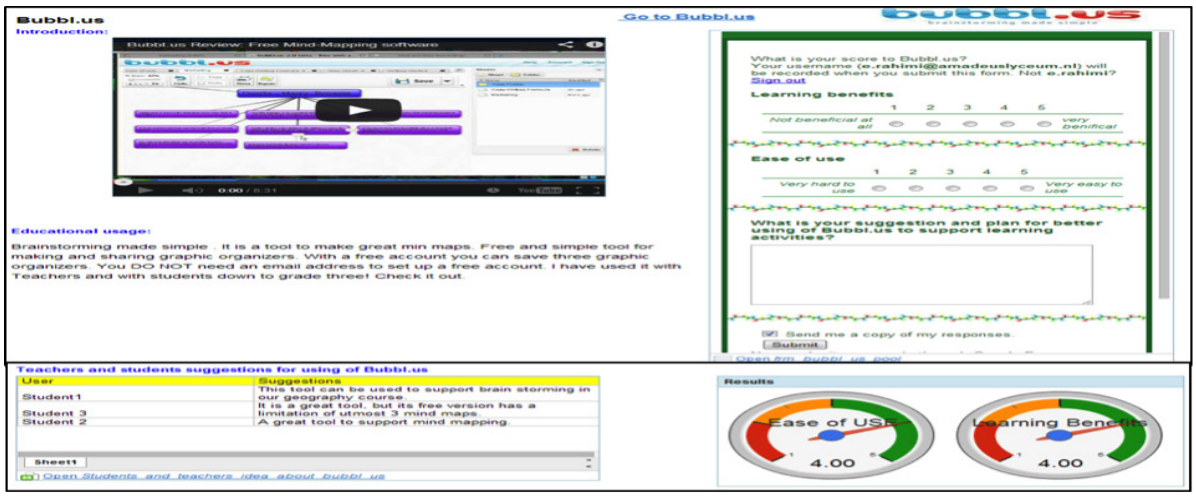

Figure 4. A page for introducing each web tool and receiving students feedback about the tool

The personal part provides students a flexible activity space to manage their learning activities and develop their PLEs by exploring and exploiting the learning affordances of the provided choices and a rich set of the available gadgets.

For each web tool seeding the PLE, an introduction page illustrates the tool and its educational usages, as shown in Figure 4. Also, the students are asked to evaluate the tool and explain its learning affordances based on their personal experiences with the tool. This information then can be used by teachers to reseed and retool the learning environment and design appropriate learning tasks.

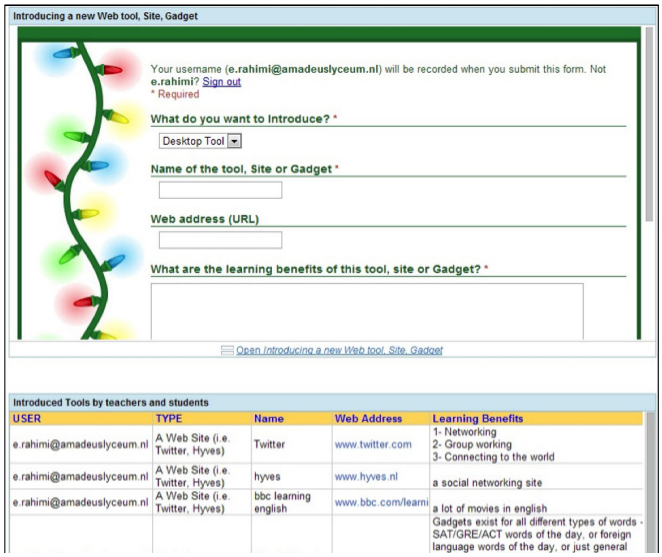

Figure 5. A page for introducing new learning resources by students and teachers

As a part of the reseeding phase, as shown in Figure 5, the students are encouraged to introduce new learning resources they have found useful to be used to reseed the PLE.

5. Evaluation and testing of the solution in practice

5.1 Identify research methods

Due to the exploratory nature of this research, we chose qualitative research methods to support data gathering and analysis processes (Yin, 2008). Yin identified six possible sources of evidence including: documentation, physical artifacts, interviews, direct observations, participant-observation, and archival records. For the purpose of this study, we selected the interview as the main method to collect data. We adopted a purposeful sampling technique (Patton, 2002) to select teachers with a variety of background and disciplines, and with a different amount of experience related to using web tools to support their teaching process.

5.2 Gather and analyze data to answer research question

After having identified the research methods, we started to collect and analyze data. For data collection, six interviews with ten teachers were conducted. We used the following procedure to conduct each interview: A few days before each interview an account to access to the prototype was created and sent to the interviewees along with a brief description of the PLEs concept. Due to the unfamiliarity of the most of the interviewees with this concept, we asked the interviewees to explore the prototype before the interview meetings to gain an initial perception of the PLEs concept and prototype. Each interview lasted between one to two hours. During each meeting we first started by introducing and explaining the PLEs concept and then receiving their reactions and feedback about the concept and prototype based on their previous experiences of using web tools in their classrooms. As stated by Ma & Harmon (2009), linking the topic of discussion to the past experience of interviewees can mentally prepare them to use their experiences to evaluate conceptual models and prototypes. In the second part of interview, we described the different functionalities of the prototype. We presented different scenarios to explain how these functionalities can support their teaching practices as well the learning process of students. After this part, we asked the interviewees about their final thoughts, perceptions, expectations and reactions to the prototype.

The collected data then were analyzed by using Atlas.ti software. The analysis procedure included transcribing audio data, entering data into Atlas.ti, coding data, reading the transcripts organized by codes, writing memos, recoding and merging similar codes as necessary, grouping codes into categories, creating network diagrams by establishing relationships or links between codes, and writing up conclusions.

5.3 Draw conclusions and determine research findings

Figure 6 presents the results of the analysis phase describing the teachers' perceptions about the ways that the prototype can contribute to improving the educational process. In this figure, the first number between parentheses indicates groundedness (that is, the number of times mentioned in the interviews), the second number indicates density (that is, the number of codes to which it has a relationship).

Participants remarked that the *personal part of PLE* (7 mentions, see Fig.6) can help teachers to *realize the ways that students learn with web tools* (12 mentions, see Fig.6) and in turn it can support the *design of appropriate technology-based learning tasks* (18 mentions, see Fig.6) resulting in the *adoption of a student-centric learning approach. Furthermore, the personal part of PLE can increase the encouragement of students to find/ share learning resources* (12 mentions, see Fig.6), resulting

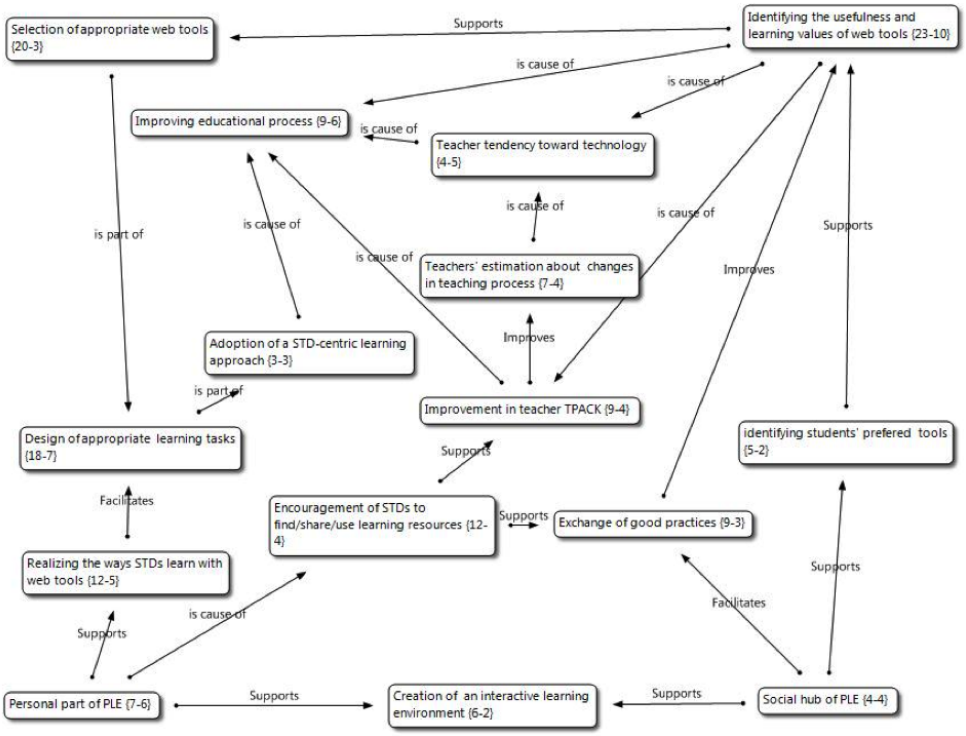

Figure 6. The perceptions of the teachers regarding the impact of the prototype on educational process

in the improvement of teacher's TPACK, i.e. the knowledge that the teacher needs to know in order to be able to teach with technology (Mishra & Koehler, 2006). As remarked by participants, one of the main issues to adopt the PLE's concept by teachers is their estimation about the required changes in their teaching process (7 mentions, see Fig.6) which can be improved by the improvement of teacher's TPACK, which in turn can increase the tendency of teacher toward technology (4 mentions, see Fig.6).

As remarked by participants, *the social hub of PLE* (4 mentions, see Fig.6) is useful to *identify students' and teachers' preferred web tools and learning resources* (4 mentions, see Fig.6) and can facilitate the *exchange of good practices* (4 mentions, see Fig.6) with regard to the teaching and learning usage of web tools. As a result, the *social hub of PLE* can assist teachers in *identifying the usefulness and learning values of web tools* (23 mentions, see Fig.6). As remarked by participants, *identifying the usefulness and learning values of web tools* has an enviable position in *improving educational process* (9 mentions, see Fig.6) and increasing the *teachers' tendency toward technology and teacher's TPACK*. Furthermore, *identifying the usefulness and learning values of web tools can support teachers in the selection of appropriate web tools* (20 mentions, see Fig.6), resulting in the *design of appropriate technology-based learning tasks*.

Participants asserted that the combination of the *personal part of PLE* and *social hub of PLE* can support the *creation of an interactive learning environment* (6 mentions, see Fig.6) by providing opportunities for students to enrich their learning experiences by using digital tools and collaborating with each other around the content and technology.

The teachers also remarked that not only students but also other teachers should be able to share their experiences, good practices, and success stories regarding integration technology as well as the learning values and benefits of web tools by using the prototype. One teacher emphasized this requirement as below:

> *Teachers have always some ongoing educational activities and projects. They have an unceasing need to know about tools to support these activities. The social hub of PLE should provide a place for teachers to share their tools and the ways that they use them. This information can be very helpful for other teachers with same needs and projects.*

6. Documentation and reflection to produce design principles for developing the proposed solution

The results have revealed the main sorts of knowledge, skills, and support teachers require to facilitate PLE-based teaching and learning processes including:

- Identifying the technological preferences of students
- Realizing the ways that students use and learn with web tools
- Identifying the usefulness and learning values of web tools
- Defining clear criteria to assess, evaluate, and introduce the learning affordances and benefits of web tools by students and teachers
- Selecting appropriate web tools to support different phases of teaching and learning processes
- Designing appropriate learning tasks by using selected web tools
- Encouraging students to choose and use web tools, reflect on and share their learning values
- Becoming aware of other teachers' practices and success stories with web tools

Addressing these requirements can improve the educational process not only by helping teachers to establish a student-centric learning environment, but also by supporting the "situated professional development" of the teachers. Situated professional development addresses teachers' specific needs within their specific environments by allowing them to gain "new knowledge that can be applied directly within their classrooms" (Ertmer & Ottenbreit-Leftwich, 2010). In this regard, Kennedy (cited in Ertmer & Ottenbreit-Leftwich, 2010) noted that the most important feature of a professional development approach is a strong focus on helping teachers understand how students learn specific content, and how specific instructional practices and tools can support student learning outcomes.

This approach to the teachers' professional development conforms with the recently emerged paradigms in teaching theories that emphasize teaching and learning are intertwined and state "teaching practices and theories of teaching should be based on knowledge and theories of how students learn" (Vermunt & Verloop,1999). From the PLEs perspective, learning is a student-driven self-regulated knowledge constructing process. In this regard, as stated by Turker & Zingel (2008), the organization of learning resources by students in a PLE into meaningful learning activities toward achieving learning goals can be considered as act of instructional design, corresponding to the forethought phase of Zimmerman's self-regulated learning model. Accordingly, this calls for theories of teaching that are based on an analysis of students' learning process ongoing throughout their PLEs.

We derived the following design principles from the research findings to guide developing the next version of the prototype:

- Teachers need to know students' technological preferences and the ways they use web tools in order to implement a student-centric teaching and learning approach and support their professional development process. Addressing this requirement calls for the addition of a monitoring and analyzing functionality to the prototype to observe the personal parts of students, trace their use of each tool, and provide appropriate information about the usage pattern of web tools.
- The personal part of PLE should provide students with appropriate technological choices. The level and scope of these choices is an important factor influencing the students' control. While a restricted personal part can lead to poorly tailored learning experiences and students' boredom and demotivation, a limitless freedom will lead to the teachers' loss of control on the students' interaction with technology. In this situation, dialogue between teacher and students is the best solution to make decision about the scope of students' technological choices.
- The results of this study indicate that the adoption of PLE-based learning by teachers strongly depends on the teachers' estimation of the required changes in their teaching process. According to Guskey (1995), the amount of change individuals are asked to make is inversely related to their probability of making the change. Hence following a step-by-step technology integration approach by focusing on teachers' immediate needs and facilitating small changes within teaching and learning practices appears to be an effective long-term strategy to implement PLEs. Also, presenting inspiring models of PLE and describing how they can support different teaching and learning scenarios can

improve the teachers' tendency toward the adoption of the PLE-based learning.

- The PLE prototype should provide opportunities for teachers to share their examples of "good teaching" that include the integration of technology. These examples can help teachers to develop confidence by hearing about or observing other teachers' successful efforts. As asserted by Ertmer & Ottenbreit-Leftwich (2010) , "observing successful others can build confidence in the observers who tend to believe if he/she can do it, then I can too."

7. Conclusion

In this paper, a new implementation and deployment model to develop PLEs in educational settings has been proposed. The model aims to put students in a higher level of control in the educational process by acknowledging and corroborating their role as active learners, contributors, and designers. The results of this research indicate that the teachers' perceptions are positive regarding the potential of the technological prototype, built upon the model, to improve the educational process. Also, the results provide the sorts of knowledge, skills, and support teachers require in order to facilitate PLE-based teaching and learning. Based on these findings, the research offers design guidelines to improve the next version of the prototype. Further research is needed to apply these guidelines, and test and evaluate the modified version of the prototype from the teachers' and students' perspectives.

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