Personal Learning Environments in Higher Education Language Courses: An Informal and Learner-Centred Approach

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Abstract

The chapter discusses the potential of personal learning environments (PLE) based on Web 2.0 applications for language courses in higher education (HE). This novel approach to the use of information and communication technologies (ICT) in education involves learners in the design of learning environments, tools and processes. The chapter begins with an introduction to the concept of PLEs and identifies drivers behind its increasing popularity. It discusses the multiple ways in which the concept has been understood and applied, and demonstrates the manner in which its principles resonate with developments in the field of computer-assisted language learning (CALL). The chapter will present the F-SHAPE project. This is a project which is being carried out in the University of Jyväskylä Language Centre and which investigates the integration of elements of the PLE concept into higher education language courses through cooperation with researchers, teachers, administrators and students. The application of a highly constructivist and learner-centred approach in the context of formal education is not without problems. Opportunities and challenges that will manifest themselves through this approach will be considered from the perspective of pedagogy, technology, students, and teachers.

Keywords: personal learning environment (PLE), learner-based approach, higher education, multimodal pedagogies, design-based research (DBR).

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1. Introduction

This chapter discusses the potential of personal learning environments as a solution to meet the challenges faced when designing learning and integrating technology for language courses in higher education today. With the proliferation of the Internet, Web 2.0 applications, social networks and gaming, students are involved in highly engaging activities in their everyday lives. They use the vast web-based knowledge resources to read and write, sometimes in foreign languages, but chiefly in the Internet Lingua Franca which is English. As Thorne and Reinhardt (2008) point out, “emerging literacies associated with digital media are highly relevant to their current and future lives as language users” (p. 560). Lankshear and Knobel (2007) suggest that youth in the developed world share a whole new mindset that is different from the traditional, industrialist mindset, and is characterised by a sense of existence and spatiality that extends to the virtual space. This “post-industrial mindset” also incorporates much of what has been said about Web 2.0 in terms of collaboration, production and participation. One of the major tasks faced by today’s world is that of bridging the “new” mindset of digital insiders and the “old” mindset on which models of education are still based.

A significant argument in the current pedagogical debate relates to our understanding of formal education. If we hold the view that the purpose of formal education is to equip students with life skills as opposed to focusing on test performance, then our understanding of what should be learned and, perhaps, how learning should take place will alter. For example, Barab and Roth (2006, p. 3) support the view of Lave (1988) that learners should be engaged in rich learning situations where learning has a direct functional value which enhances learner’s understanding of the real world, as opposed to the content being acquired with the aim of exchanging it for a test score (having exchange value). Combined with the growing emphasis on informal learning, this idea strengthens the perception of learning as a life-long and life-wide process that exceeds the boundaries of educational institutions. In the context of language learning, this means placing greater emphasis on the development of the learning competencies and resources of the individual learner, and designing learning environments in which language is not detached from the context of its use.
The PLE can be seen as one possible solution towards meeting the goals of education in the knowledge society: students need to be equipped with skills that enable them to actively seek information and construct knowledge, participate in the world, maintain learning throughout their lives and embrace continuous change. As a technological approach, the PLE can be seen as a response to the shortcomings of institutionally controlled learning management systems (LMSs) that dominate the educational field; student PLEs are individually tailored learning spaces that place control of the learning tools and processes in the hands of the learners. For language learning, there is great potential, as the PLE approach encourages interactivity and fosters the creation of learner communities combining informal and formal learning on the one hand, and providing the possibility to track and transfer learning between courses, subjects, and educational institutes, on the other. In essence, the PLE approach encourages students to become active agents in the design of their own learning.

The chapter focuses on the potential of the PLE approach through its integration into language courses at the University of Jyväskylä Language Centre. It begins by discussing the drivers behind the development of PLEs as well as exploring current understanding of learning environments. The concept is then contextualised by illustrating some recent developments in the field of computer-assisted language learning. The aims and scope of the F-SHAPE project are presented in the final section. As part of the F-SHAPE project, PLE practices are developed and integrated into language courses through close cooperation with researchers, teachers, administrators and students. The possibilities and constraints of the implementation will be considered from the perspective of pedagogy, technology, students, and teachers.

2. Drivers for PLE: Web 2.0 and new understandings of learning

The emergence and proliferation of the Internet and social media technologies play a double role in educational change in that they pose both new demands and new possibilities not previously experienced. This section of the
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Chapter links the background of the PLE ideology to recent developments in 21st century learning, Web 2.0 technologies, and learner-centred approaches in CALL.

2.1. Learning as a social and participatory activity

The social aspect of learning has long been recognised, combining as it does collaborative knowledge building and interaction. This notion has been enhanced by the development and proliferation of social media. Another aspect of learning, however, concerns the role assigned to the learner in the learning process. This entails a participatory rather than an acquisitional metaphor for learning, (Sfard, 1998). The participatory metaphor for learning is reflected in the development of ICTs by Sykes, Oskoz and Thorne (2008) who argue that Web 2.0 changes the position of the learner from consumer to producer and creator, and his/her role in the educational community to that of co-builder and contributor.

There is a significant gap between the way in which students engage with new media and ICTs in their daily lives and the way in which school practices rely mainly on print media (Luukka et al., 2008, cf. The Two Mindsets by Lankshear & Knobel, 2007). Commensurate with the rise of networked information and the Internet, the volume of information available has increased to a level that a key ability required from future professionals is related to seeking, evaluating and managing information and knowledge. The formal education setting can no longer be regarded as the only place of worth in which knowledge resides. In today’s world vast quantities of information are available to those who possess the skills and motivation to go in search of it. This means that, as opposed to focusing on content knowledge alone, education must focus instead on providing the skills and competencies necessary for learning, constructing knowledge and managing information. As a consequence of this, learners can no longer play the role of passive recipients of information, but rather should assume a new role as active participants in the process of developing their own expertise through selecting, deconstructing, building and creating knowledge and new meanings together with their interlocutors.
The possibilities for education created by the development of social technologies are well documented by Solomon and Schrum (2007), who state that Web 2.0 signals “a transition from isolation to interconnectedness” for its users, as it promotes a number of ways in which multiple users can participate and collaborate in writing, editing, commenting and creating (p. 13). The use of Web 2.0 and the adoption of its practices are still at a very preliminary stage in the educational domain, and their potential in the context of implications for learning are, as yet, largely untapped.

2.2. 21st century learning environments

The ideology behind the PLE is reflected in current thinking relating to 21st century learning and learning environments. The Partnership for 21st Century Skills (2009) regards 21st century learning environments as “support systems that organise the condition in which humans learn best –systems that accommodate the unique learning needs of every learner and support the positive human relationships needed for effective learning” (p. 3). Furthermore, 21st century learning must take place in contexts that “promote interaction and a sense of community [that] enable formal and informal learning” (Cornell, 2002, in Partnership for 21st Century Skills, 2009). The concept of the PLE is supported by the theories posited in 21st century learning as it is tailored to the individual’s learning needs and incorporates a strong social aspect.

2.3. Web 2.0 and personal learning environments

Felix (2003) claims that the paradigm shift in pedagogy towards constructivism was already occurring in the absence of technology, but that multimodal and networked technologies enhanced its appeal. Learner-centred, personalised views of learning have long been in existence and have also been boosted by the inherent changes in the nature of the web which have altered the approach to the use and development of technologies.

The concept of Web 2.0 and PLEs is intertwined. Downes (2007) posits that the values of Web 2.0 and the concept of PLEs are essentially as one,
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namely “the fostering of social networks and communities, the emphasis on creation rather than consumption, and the decentralisation of content and control” (p. 19). Worthwhile web applications, which are an essential element of student PLEs, facilitate the arrangement of learning resources and tools and the creation of learning networks, while at the same time encouraging communication and the publication of both the process and the outcome of the learning experience.

The pedagogical aims of the PLE are based on the ideas of constructivist and socio-cultural theories of learning, but it is claimed that a whole new theory of learning, such as the concept of connectivism (Siemens, 2004), is demanded in the highly networked world in which PLEs currently exist. By conceiving of the PLE first and foremost as an ideology that places emphasis on learning rather than on teaching, and that promotes learner responsibility and control, the concept is closely bound up with the larger field of educational and pedagogical change. This means that the motivation for research and development around the concept of the PLE is primarily pedagogical, rather than technological, even though much of what it encompasses is related to or results from the development of ICTs.

2.4. Web 2.0 and learner-centredness in CALL

CALL practitioners have readily embraced possibilities of Web 2.0 for language and literacy studies. Sykes et al. (2008) envisage emerging technologies being used in the near-future to create meaningful context by adding “real world relevance” to facilitate L2 communication in the classroom. Wikis are already being used to facilitate joint content creation; blogs serve as arenas of self-expression and “enhanced readership” (Sykes et al., 2008, p. 532). Social networks such as Facebook and MySpace allow students to network, interact and share. Social bookmarking sites serve a platform for organising content and for building and sharing knowledge. These tools provide opportunities for networking with people who share similar interests, people joining to form communities of practice (see e.g., Wenger, 1998), and people interacting within an affinity space (Gee, 2004).
Kenning (2007) posits that the motivation for ICT integration into language education is significant because of the inherent role ICT plays in everyday communication. This is not confined to equipping learners with transferable skills such as electronic literacy, but entails “the fact that language, in today’s world, tends to be experienced as mediated communication” (Kenning, 2007, p. 158). She quotes Warschauer and Healey (1998), who state that “the ability to read, write, and communicate effectively over computer networks will be essential for success in almost every sphere of life” (p. 64). Kenning (2007) calls for embedding language learning in social practices, not only for the sake of motivation and relevance, but “in order to capitalise on student experience in the world outside” (p. 159).

In their review of design practices in CALL, Levy and Stockwell (2006) identify learner-centredness as a core element in the design of CALL materials and learning environments. As research in CALL has perhaps previously concentrated around a single technology within the bounds of a single theoretical or pedagogical orientation, the design process today is far more complex and often involves the application of various theoretical approaches and the inclusion of complementary technologies. As Levy and Stockwell (2006) put it, “[p]rincipal among these [issues that come to the fore] is perhaps the multidimensional nature of the design process as developers try to weave together elements of theory, pedagogy, technology, and best practice, often drawn from a number of different fields or disciplines” (p. 27).

As a general principle of design in CALL, understanding the learners’ experiences and expectations of technology use is common practice. However, it is noteworthy that teachers continue to be seen as the lead designers of the learning process with learners being treated as mere bystanders. Learner needs and experiences are considered, but learners do not have a contributive role in the actual design process. The PLE framework changes this by involving learners in the actual design of learning materials and structures through selecting tools and applications, work modes and resources. Within the PLE approach, the role of the student alters from that of participant to contributor in the overall process.
3. Approaches to personal learning environments

Heretofore, pedagogy has been put forward as the main motivation for the development of PLEs. A large proportion of the work on PLEs, however, is motivated by interests in developing new technologies. This section describes pedagogical and technological approaches to PLEs, and summarises the values they have in common. The binary of ownership and control is then discussed, followed by some examples of PLE implementation.

3.1. PLE: a pedagogical or a technological concept?

Definitions of PLEs vary depending on the viewpoint of the authors regarding technology and pedagogy. Attwell (2007) describes the PLE first and foremost as an ideational concept that meets many of the challenges educational systems face today. Attwell (2008) elaborates by stating that the PLE represents a new approach towards developing e-learning tools: PLEs are no longer tightly integrated in a virtual learning environment (VLE) but are combined into a flexible entity that can be selected and adapted according to the needs of the individual learner. This definition of a PLE emphasises the philosophical and ideological aspects of the concept over a specific technological solution, and it is particularly fruitful when the interest is in developing practices and pedagogies around the concept.

An alternative approach to the PLE is a more technological one. PLEs can be seen as a response to the shortcomings of the institutionally controlled learning management systems (LMSs). LMSs have typically been designed with an administrative focus, as opposed to a pedagogical one. Van Harmelen (2008) sees PLEs as part of a “learning ecosystem” (p. 35), comprising the computer-based parts of the ecology. In his view, the ecosystem consists of resources available to the learner: people (peers, teachers), print materials, computational materials (including the Internet), and various other resources (such as pen and paper). A student PLE would comprise the computer-based parts of the ecology, including desktop programs, browsers, and mobile devices. However, this view has its dangers: instead of integrating technology into learning, it builds up artificial
boundaries between ICTs and traditional, print-based tools, keeping the work on the computer separate from the work in the classroom.

3.2. Reconciling the binaries of ownership and control

The pedagogical and technological approaches to PLEs are not difficult to reconcile, as they share much in common: the consideration of personal and social aspects of learning, the preference for open and free technologies, and a focus on the learner and the learning process. A more relevant consideration is the extent to which learner-control and ownership can be realised in the context of formal education. Inspired by the PLE ideology, traditional LMSs and platforms have been developed to support both social and personalised aspects of learning. However, these solutions can be criticised, as an environment that is managed by the educational organisation contradicts the inherent principle of the PLE belonging to the students.

Peña-López and Adell (2010) and Laakkonen and Juntunen (2009) bring a conciliatory perspective to PLEs. They regard PLEs as personal devices or systems, which can incorporate institutional resources and tools. The educational institutions, in turn, have to be “PLE-able, they have to rethink themselves, be more flexible, more open, and adapt to the new learning realities” (Peña-López & Adell, 2010). Wheeler (2010) proposes a hybrid approach to PLEs, arguing that students need structure and support when adopting Web 2.0 tools and building their learning environments.

3.3. Some solutions for PLEs

In its simplest form, a PLE is a loose collection of tools from which learners can choose in order to organise their learning. The collection may be presented in the form of an image, for instance, which demonstrates the tools and resources that can be used for learning, helps identify the functions for which the tools are used, and thus enhances learners’ awareness of the way in which they learn best, and of the contexts in which their learning takes place. For example, a student PLE for an English as a foreign language (EFL) course may
look like Elena’s mindmap, in which she has grouped the tools and resources around the concepts of Cultural Competence, Language Competence, People & Places, and Information, and then into subsections such as Informal/Formal and Listening, Speaking, Reading and Writing. There are as many ways to map a PLE as there are learners, and a collection PLE diagrams can be found in the EdTechPost wiki. The process of learners constructing their own learning environment involves not only tracking their learning process, but also familiarising themselves with the tools available, and the possibilities for their use.

Guth (2009) investigates the use of PLEs as part of language courses. She describes a research project set up to study the potential of social software for teaching EFL using an action research approach. Similar to design-based research, action research assumes a cyclic process, in which practices and tools are adapted and readapted after collecting feedback and data during the process. Guth’s students built their PLEs using personal blogs. The blogs were complemented with a feed reader and a social bookmarking site. Student-centredness was achieved in that no teacher-produced materials were used and students were charged with the responsibility of finding resources to support their own learning. It was envisaged that as the learning community would grow, resources would develop into shared learning materials.

Drexler (2010) proposes a model of a networked student. In her study the primary goal of the PLE was to replace the traditional textbook. She made use of customisable web pages (e.g., Symbaloo, PageFlakes, iGoogle, NetVibes) to pull together information from various sources: social bookmarking sites, news readers, blogs, podcasts and digital notebooks.

4. Integrating the PLE approach in HE language courses

This part describes the F-SHAPE project, in which university level language courses are developed based on the PLE approach. After a general introduction
to the research project, followed by an examination of the research context, it then focuses on the principles and practices of PLE implementation.

4.1. The F-SHAPE project

The F-SHAPE (Future Space for Shared and Personal Learning and Working) is a research and development project with a focus on flexible learning solutions to fit the needs of adult learners and work life. The project explores the boundaries of various different learning spaces: virtual spaces, personal and shared space, as well as informal and formal learning contexts. The concept of PLE is used as an alternative to traditional approaches to learning environments: the F-SHAPE project seeks to develop learning concepts, solutions and environments that respect the needs of the individual learner, while still acknowledging the interests of the organisation and supporting collaborative and community-based aspects of learning (The F-SHAPE project website 2009).

The project follows the principles of design-based research (DBR), (see Reinking & Bradley, 2007). DBR involves a goal-oriented, pragmatic and iterative view of research and proposes a strategy for developing learning practices through empirical research. One of the contexts for research is the University of Jyväskylä Language Centre, in which new solutions for preparing students with skills needed for work life and for lifelong language learning are developed as a joint venture by researchers, teachers, students and administrators.

4.2. The University of Jyväskylä Language Centre as a context

Much of the work on PLEs from the pedagogical point of view has been driven by the interest of individual teachers (e.g., Drexler, 2010; Guth, 2009). In the context of the Language Centre, the aim is to integrate the PLE ideology on a broader, organisational level. Essential prerequisites for this type of development include the close involvement of the director, guaranteed administrative support, and adequate resourcing for teachers in terms of time allotted for the project. The operational culture of the organisation is a factor of key importance.
The University of Jyväskylä Language Centre offers an excellent context for developing the PLE concept and for exploring the pedagogies and practices which stem from it. The unit has a long tradition of research and development, and its staff enjoys a high level of collegiality. Many of the goals of the PLE approach already constitute part of the teaching philosophy of the Language Centre. Multiliteracy, ICT skills, and transferable, life-long, independent learning skills are cited as points of focus in the teaching of academic English language and communications skills (see the Language Centre website). The general teaching goal of the unit is to create effective and convincing communicators, employing a multimodal approach to teaching. This approach links meaningful communication to real life situations, supports individual and peer processes, and encourages creativity and self-regulation. In the Finnish HE system, language and communication courses constitute a compulsory element of all degree programmes and students are drawn from a range of academic fields and backgrounds.

4.3. **The project in practice**

In the F-SHAPE project at the Language Centre, principles of PLE are integrated into regular language courses, with the aim of equipping students with the competencies needed for the world of work and for lifelong language learning. The process of PLE implementation is initiated through meetings and discussions with the teachers involved in the project. For each individual course the “PLEisation” is conducted in close cooperation with the teacher. Resources, goals and tools are identified so that course aims and evaluation, opportunities for learners to develop their PLEs and for teachers to apply learner-centredness and learner-initiation to work modes can be achieved.

In order to develop PLEs, learners need support and structure. These are provided jointly by researchers and teachers. The first step is that learners are encouraged to collect the tools they already use for language learning, and to identify the potential for language learning opportunities in the technologies and applications they use in their everyday lives. These tools and practices are then evaluated and adopted for use on the course. Introduction of additional tools and training in the use of tools for learning may be necessary.
During and after each course, feedback and information concerning experiences of the process are gathered and evaluated and subsequently adapted to better meet the initial goals. This information informs the practices adopted in subsequent courses.

From the technological perspective, what is required is a solution that would facilitate:

- the creation of personal spaces with different levels of publicity; in these spaces students can collect the resources they need, access tools, and make visible the process and contents of learning;
- sharing and collaboration, building a joint library of resources and tools, collaborating for knowledge construction and creativity;
- networking with peers and with larger communities; to find people who share similar interests and work in associated fields.

The solution can consist of a set of Web 2.0 applications, and it can make use of the LMS offered by the organisation when applicable. This type of approach is akin to the model of PLE presented by Wheeler (2010). In the current study, the PLE in formal context should be built around learners’ needs and should capitalise on the tools and practices employed by them in their everyday lives. The resources and requirements offered by the institution should not be ignored, as they provide valuable tools for the development of the PLE, such as computers, mobile devices, applications, desktop programs, and technical support.

5. **PLE: opportunities and challenges**

There are both opportunities and challenges that need to be considered when implementing the highly ideological concept of the PLE in the context of formal education. Here we discuss the opportunities and challenges with reference to students, teachers, pedagogy, and technology respectively, and propose some solutions based on observations made during the F-SHAPE project.
5.1. **Students**

Implementing the PLE means taking a step towards self-regulated learning and learner autonomy (Atwell, 2007). Warschauer (2000) reports that motivation is strongly increased when learners find the activities they engage in socially and culturally relevant (p. 52). Autonomy and self-direction are closely related to learner motivation through self-determination theory and attribution theory. According to Deci, Vallerand, Pelletier and Ryan (1991, in Benson, 2001, p. 69), intrinsic motivation leads to effective learning, and it is promoted by settings where the locus of control is with the learner. As there is a relationship between intrinsic motivation and self-directedness, taking control of the learning may help learners to develop motivational patterns that lead to more effective learning results (Benson, 2001). In the field of Attribution theory, Benson (2001) quotes Dickinson (1995, p. 172) who states that learners who believe that they have control over their own learning tend to be more successful.

Taking responsibility for their own learning requires of learners the ability and skills necessary to identify complex, real-life problems, and to construct knowledge in order to solve them. Some of the students may not be familiar with suitable web applications and consequently significant effort may be required in order to become proficient in their use. Moreover, many of the teachers involved in the project have reported on their previous experiments with learner autonomy and expressed their concerns, as many students seem reluctant to accept responsibility for their learning. A key question here is how to encourage teachers and engage students in self-directedness when it is a question of delayed rewards. In the F-SHAPE project we are exploring solutions in theories of gaming and learning (Gee, 2003) through fostering creativity and play in order to support language learning.

5.2. **Teachers**

The PLE approach (like learner-centred approaches in general) requires of teachers the adoption of a new role as coaches, or facilitators in the process of learning. They are faced with the challenge of balancing learner autonomy and
structure, personal choice and general evaluation criteria (McLoughlin & Lee, 2009). Teachers may be concerned due to inadequate proficiency with regard to the usage of tools employed by their students. This is not necessary, however. What is required is that teachers have a general understanding of technologies suitable for learning, but the mastery of individual applications is not essential. When teachers are new to social media and learner-centred design, they need time, resources and pedagogical support from the institution in which they work. The administrative support from the Language Centre motivates the teachers involved in the project and provides them with the time resources to rethink their courses and to develop pedagogical practices. In addition, close cooperation with researchers who have knowledge of Web 2.0 applications and learner-centred pedagogy will encourage the teachers during the process.

5.3. Pedagogy

There are several pedagogical challenges related to the creation of PLEs in a formal context. The most salient is perhaps the intrinsic paradox of applying an apparently informal approach in the context of formal education with set learning goals, standard forms of assessment and prevalent practices of ‘teacher-centred’ modes of work. Changing practices and modes of production require a thorough reconsideration and modification of assessment: if the learner holds the control over the learning process, teachers have to develop alternative types of assessment. To make full use of many Web 2.0 technologies, the learning resulting from and manifested in the creation of collaborative effort has to be recognised.

5.4. Technology

With regard to technology, several points remain unresolved. Although the requirements of learner-centredness, networking and openness are becoming acknowledged in the design of LMSs, many developments are mere add-ons, and do not challenge the fact that many of the core systems were originally designed for administrative purposes. However, building a PLE on the basis of free Web 2.0 tools only requires that a careful selection of applications be
used in terms of safety, stability, and performance. As it is the nature of the web to be under continuous change, with new applications being created and old ones becoming obsolete, new features affecting the usability potential of applications, and changing terms of service effecting the possibilities of use, one has to embrace change and ensure that both students and teachers will be equipped to cope with the change and discover new tools with which to work.

Another point of consideration is that in many organisations the access to external web services can be regarded as a threat as opposed to a resource for extending the learning environment. In such cases, a more limited version of a PLE can be adopted through extending the VLE/LMS already used in the organisation.

6. Conclusion

It is commonly agreed that the potential for learning does not lie in the development of technologies or in the novelty of applications, but rather in the way in which we harness them for learning, i.e., in the ideologies they enable. In this chapter it has been argued that the PLE approach shows great potential for CALL, as it is a step towards active, learner-directed learning that is not detached from its natural social context. When developing their PLEs, language students need to reflect on their learning, find ways to express their progress, and develop new practices. Implementing the PLE framework is not about technology. It is about people, and about change, not about changing the way we understand learning but about the way we distribute responsibility over learning and teaching, respect the individual learners and teachers, and focus on learning about learning instead of learning about content. Moreover, in spite of its name, the PLE approach is not about individuals as much as it is about networks, sharing, and creating.

Many of the projects and developments on PLEs have either been promoted by technologists or by individual, enthusiastic teachers. If the concept is to be implemented on a larger scale in higher education, a high level of teacher involvement and motivation are necessary. PLE is a new concept, and is based
on a field that is still taking its first steps (integration of Web 2.0 in education). Teachers are the key element, as they are the interface and mediator between learning and curricular requirements. Bringing PLE to educational institutions requires building on teacher experience and on sound pedagogical principles on the one hand, and sufficient support, resourcing and flexibility from the institution, on the other.

Much previous research has shown that a shift in practices of teaching and learning is hard to achieve – changes often remain temporary, superficial or isolated. As an ideology, PLE encompasses a demand for deeper level change in the way we see pedagogy and education: the understanding we have of teaching and learning. Although the approach is not a panacea, it can be seen as one step towards the future of language learning. Placing learners and teachers in focus may increase feelings of agency and ownership and result in permanent change. What can be accomplished is to build on practices, competencies and language repertoires that students with the Lankshear and Knobel’s (2007) “new” mindset are familiar with. In the course of the F-SHAPE project we can achieve research-based evidence on the implementation and implications of the PLE approach, thus contributing to the development of technology integration and 21st century pedagogy.

References


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**Websites**

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F-SHAPE project website: http://fshape.wordpress.com

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