LEARNING TO SOLVE LIFELONG PROBLEMS:ONLINE PBL

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ABSTRACT
Learning continues long after an individual leaves formal education, the workplace is one of the main environments in which people continue to learn. Learning in the workplace is often informal and unrecognised. (Hamburg, 2012) Furthermore, learners are limited to skills that are internal to the organisation. To allow them to overcome this drawback, they need to be provided with capabilities that enable them to acquire external knowledge to widen their skills base.

This paper will explore will outline how online problem based learning (PBL) can be used as a pedagogy for lifelong learning in the workplace providing individuals with the skills they need to continually solve problems and adapt to changes that arise in the workplace.
It will provide a case study of the development of an online problem based learning programme as part of an EU programme.

CHANGING NEEDS OF LIFELONG LEARNERS
Lifelong learning emphasises the importance of continued learning throughout a person's life. (Laal, 2011) The individuals learning needs may vary depending on their age, past experiences, personal or professional circumstances and can take place informally or formally (UNESCO 2014)

It spans a wide variety of contexts, mediums, and learner profiles and therefore it is very difficult to speculate the curriculum or separate the context for which the individual requires their learning.

Traditionally formal education is discipline specific with learners undertaking programmes in a specific field, (Costley and Dikerdem, 2011; Kettle 2013). However, when learners graduate from formal education their skills needs evolve as they progress, change careers and adapt their lifestyle, learning becomes more informal and situated. Furthermore, due to the increasing acceleration of change over the past decade skills now become obsolete

quickly. The Bruges Communique (2010) emphasised the need to "acquire knowledge skills and competencies that are not pure occupational" to keep pace with such changes. Therefore, it is imperative that individuals should be provided with competences that allow them to gather the material they need to identify and satisfy their emerging skills needs.
Over the past number of years technology has significantly impacted professional and personal lives. The digitisation of how we work and socialise has resulted in a significant increase in the availability of digital information. We have never had access to so much information, big data applications, social media, open educational resources can increase the learning capacity of individuals. However, the navigation and application of this data can prove difficult, for example it is estimated that workers spend over 20% of their time searching for information. (Chui et al 2012). In a complex fast changing world providing learners with the capacity to find and apply the correct information to solve a given problem quickly is key. Therefore, digital information literacy skills become increasingly important, (UNESCO, 2017) However it is estimated that 45% of EU citizens do not have digital skills. (EURASHE, 2017)

Furthermore, a New Skills Agenda for Europe (European Commission, 2016) highlight the increasing importance of digital competences, entrepreneurship, critical thinking, problem solving and learning to learn to equip society to deal with constant change.

However, there are significant skills gaps in these areas, for example only 30% of adults currently have the capacity to "evaluate problems and find solutions" (OECD, 2016). In the Archimedes project it was highlighted that 80% of respondents had instances where they found it difficult to solve a problem.

To facilitate lifelong learners in developing these skills a problem oriented curriculum is required that teaches learners how to gather the knowledge they need to solve complex business problems while upskilling.

PBL: ADDRESSING THE NEEDS OF LIFELONG LEARNERS
Problem Based Learning (PBL) is a learner centred approach, the teacher plays the role of a facilitator that guides the learner through inquiry to solve a problem. Problem based learning has been shown to increase deep learning and allow learners to develop skills in problem solving, logical thinking, creative thinking and communication. (Sendag 2009)
In PBL rather than a tutor speculating the content the learner needs, teaching this to them and assessing students, the learner is presented with a complex business problem. The learner then undertakes a process to identify and apply the relevant material required to solve this problem. A trained mentor or facilitator guides them through this process. Thus, the learner is self-directed and motivated. (Loyens et al 2008)

Despite the reported benefits of PBL, it does not come without its limitations. Hmelo Silver (2004) highlighted that PBL might be difficult for learners who find reflection and articulating their thought processes difficult and may need to be supported using a questioning approach.

Hunag (2011) highlighted that the transitioning period from traditional education to PBL is particularly difficult for learners in the initial stages. Jost et al (1997) found that this was due to uncertainty about their roles, what was expected of them and the absence of a

predefined framework (Fiddler and Knoll, 1995). However, many studies have found that these issues ease as the learners adjust to PBL.

Hunag (2011) suggest in easing this transition educators should inform learners of the PBL process and provide excerpts of learners PBL experiences.

For lifelong learners who are situated in the workplace they encounter complex problems daily, therefore by allowing them to leverage from problem based learning could provide them with an opportunity to upskill while remaining in their workplace environment. Due to its collaborative nature it allows learners to avail of external knowledge and expertise.

ONLINE PBL:A CASE STUDY

The European Erasmus+ project "Supporting PBL in small and medium sized enterprises (SMEs) through ICT facilitated mentoring – Archimedes" funded between 2014 to 2016 was concerned with developing a framework to allow those working in companies to use problem-based learning to upskill in the workplace. Many of those working in companies prefer informal learning (Hamburg, 2012) The project wanted to explore methodologies of how to allow employees to leverage from the workplace environment to upskill. To realize this objective

1. A survey was conducted with learners in 340 SMEs regarding their learning preferences, problems faced and how they overcame them and the use of ICT. A follow up focus group with 66 participants was performed to explore the underlying reasons for the survey results.
2. From this an accredited curriculum was developed that allowed those in SMEs to apply the PBL process as a learning methodology
3. As learners where situated in the workplace an ICT platform was developed to support the PBL process and allow learners from other companies to collaborate with each other
4. The platform and programme was piloted with 160 learners in five European countries

Experiences of lifelong learners in SMEs

The survey conducted illustrated that 84% of individuals had preference for on the job training. With skills needs focusing on problem solving (73%), technical (68%), teamwork (66%) and communication (64%)

Despite their disposition for informal learning the number of limitations were reported, determining if they had acquired the skills (23%), learning was unstructured (24%) and lack of staff to implement the training (20%). Within the focus groups it emerged that immediately after training there was significant enthusiasm however this lead to drop off after a period.

Eighty percent of individuals had instances where they found it difficult to solve a problem. Of these 58% found a work around, 28% asked a colleague in another company and 30% searched the internet.

It was considered these problems could be alleviated by aligning the learning to company challenges (48%), developing a learning culture (33%) and aligning the learning to

company strategy (34%). Culture was also an issue that was discussed at length in the focus groups.

Respondents believed that the problems occur due to external reasons (51%). The majority of individuals felt that these problems could have been prevented (73%). Of those respondents, 41% highlighted that they could have been avoided by structured problem solving and 46% through new skills.

Of those that felt that the problems could not be prevented, 55% said that they were problems that just had to be dealt with and 41% felt that they had no control over these problems.

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Delivering PBL to lifelong learners
To allow learners in a working environment to leverage from PBL it is necessary to deliver learning through technology.

Cameron (1999) explored the concept of distributed PBL (dPBL) arguing that it could provide huge benefit allowing learners from different cultures contexts and backgrounds to collaborate similarly to the real world. However, he found the lack of technology a barrier to dPBL. Archimedes addressed this gap by developing a PBL ICT platform. The platform provides

1. Communication capability in the form of online discussion forums and web conferencing software to allow the groups to interact
2. Collaborative problem space to allow the problem based learning group to work together on each stage of the problem based learning process. These problems can provide a reference point for other learners
3. Learning material
4. Sample solved problems

See Figure 1 for an illustration of the platform functionality

Figure 1: Archimedes ICT platform

Cash flow problem

How to solve a problem

Delete Problem

| Meeting Point | Step1 | Step2 | Step3&Step4 | Step5 | Step6 | Step7 | Reflection | | No Tabs |

Step1 - Clarifying difficult terms

Term to clarify	Description	Action
Expenditure	Our main costs are rent, light, heat and we have a large amount of staff costs, the main staff costs are sales representatives	
Stock	Some months have a surplus of stock and other months a deficit	

Clarify a new term

Problem name * Cash flow problem

Term to clarify *

Description

Figure 2: Archimedes ICT platform – Collaborative Problem Space

To alleviate transitionary problems reported by Hunag (2011) Archimedes developed learning material to inform learners of how to complete each stage of the PBL process. The learning material is delivered online in video and text based format. The learner attended a weekly online tutorial with their PBL group. In addition, the ICT platform provided the learner with a library of solved PBL problems undertaken to scaffold the learner through the process.

In a work place environment, the approach to PBL will vary from the academic environment as the problem will not be predefined for the learner. It will be the responsibility of the learner to define a relevant problem in their company and identify the relevant learning material to address it. Thus, the learning is highly self-directed, and company driven. As a result, additional steps had to be integrated into the traditional 7step PBL process.

Furthermore, as the programme focuses on the use of the PBL process rather than discipline specific learning material, learners will learn how to leverage from external experts due to the online nature of the programme they can continue to access these expertise after the project.

CONCLUSIONS
The program and platform were piloted with 160 learners throughout five European countries. Despite a high dropout rate most students (92%) found the programme of value reporting they had learned skills in problem solving, collaboration, critical thinking and information literacy. A high portion of learners stated that they would use the PBL methodology again. Unexpected reported benefits included the use of the ICT platform as a reference tool for further learning and as a knowledge repository. Learners also reported

benefits such as exposure to cross cultural collaboration, allowing them to avail of external expertise and developing a culture of learning in their organization.

Several suggestions were made to improve the delivery of the programme, the introduction of activities to foster collaboration in the initial stages was mentioned by many respondents. Learners were reluctant to communicate with each other in the initial weeks of the programme and this may have contributed to poor student retention. As a result, 'ice breaker' activities are suggested.

 Also, learners required the program to be more structured, so it is clear what is expected of them on a weekly basis. As PBL presents learning in a different format asking the learners questions or posing problems before content, learners often find it difficult adapt and need additional structure.

Based on the findings the seven step PBL process which has been widely adopted in higher education to date was extended to a thirteen-step workplace PBL framework
The project illustrated how problem based learning can be applied in the workplace and how it can allow lifelong learners to structure informal learning in the workplace to acquire skills in complex problem solving, critical thinking and communication. Further reported benefits such as the potential of PBL to allow learners to develop skills in information literacy and the ability of PBL to foster learning culture should be explored in further research

REFERNENCES
Cameron, T., Barrows, H.S. and Crooks, S.M., 1999, December. Distributed problem-based learning at Southern Illinois University school of medicine. In Proceedings of the 1999 conference on Computer support for collaborative learning (p. 10). International Society of the Learning Sciences.

European Commission (2010) The Bruges Communiqué on enhanced European cooperation in vocational education and training for the period 2011-2020. In *Communiqué of* the European Ministers for Vocational Education and Training, the European Social Partners and the European Commission, meeting in Bruges in December 2010 (Vol. 7, pp. 2011-2020).

Chui, M., Manyika, J., Bughin, J., Dobbs, R., Roxburgh, C., Sarrazin, H., Sands, G. and Westergren, M., 2012. The social economy: Unlocking value and productivity through social technologies, McKinsey Global Institute, July 2012.

Costley, C. and Dikerdem, M.A., 2011. Work based learning pedagogies and academic development. http://eprints.mdx.ac.uk/8819/1/WBL_PAD.pdf   Accessed on the 19th October

EURASHE (2017) Professional Higher Education 4.0: A Change for Universities of Applied Sciences, Le Havre, France, 30-31 March 2017 https://www.eurashe.eu/library/mission-phe/EURASHE_AC_LeHavre_170330-31_proceedings.pdf

European Commission (2016) Communication from the Commission to The European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions: A New Skills Agenda, Working together to strengthen human capital, employability and competitiveness

Hamburg, Ileana (2012) Using Informal Learning, e-learning, and cooperation in SMEs. In: International journal of e-business development 2, no. 2, p. 28-31

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do learners learn?. Educational psychology review, 16(3), 235-266.

Huag, W. (2011) Theory to reality: a few issues in implementing problem-based learning, Education Tech Research Dev, vol. 59, 2011.

Jost, K. L., Harvard, B. C., and Smith, A. J. (1997) "A Study of Problem-Based Learning in a

Graduate Education Classroom." In Proceedings of Selected Research and Development Presentation at the National Convention of the Association for Educational Communications and Technology, 19th, Albuquerque, Feb. 1997. (ED 409 840)

Kettle, J., 2013. Flexible Pedagogies: employer engagement and work-based learning. Higher Education.

Laal, M., 2011. Lifelong learning: What does it mean?. *Procedia-Social and Behavioral Sciences*, *28*, pp.470-474.

Loyens, S. M., Magda, J., & Rikers, R. M. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. Educational Psychology Review, 20(4), 411-427.

OECD (2016) Policy Brief on the Future of Work: Skills for a Digital World, https://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf

Şendağ, S., & Odabaşı, H. F. (2009). Effects of an online Problem Based Learning course on content knowledge acquisition and critical thinking skills. Computers & Education, 53(1), 132-141

UNESCO (2014) UNESCO Education Strategy 2014–2021

UNESCO (2017) Working Group on Education: digital skills for life and work