

Fostering Eco-innovation in SMEs through Bridging Research, Education and Industry

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Abstract:

Small and medium sized companies (SMEs) assure economic growth in Europe. Generally many SMEs are struggling to survive in an ongoing global recession and often they are becoming reluctant to release or pay for staff training. Some of them have had to innovate in order to be competitive (European Commission, 2015: 'Innovation in SMEs' is important being a driver for growth, employment and reducing of financial barriers).

The absence of collaboration between knowledge producers (academia) and knowledge users (industry) is real and frustrating and has a negative effect on the innovation and competitiveness of SMEs. The gap between researchers and SME staff is sometimes deliberate, sometimes accidental caused by a misunderstanding of the requirements and objectives of the other.

In this paper we present shortly the learning methods in SMEs particularly the Problem Based Learning (PBL) as an efficient form for SMEs and entrepreneurship education.

Keywords

Innovation, SME, E-learning, Problem Based Learning (PBL), Cloud Computing.

Learning in SMEs

- As environmental problems came more and more into focus, concepts as eco-innovative entrepreneurship, new business strategy that incorporates sustainability throughout all business operations based on life cycle thinking and in cooperation with partners across the value chain.
- Results of projects show that SMEs are restricted in the efficient use of technology for learning and in adequate management learning approaches.
- The most used learning in SMEs is informal one and the predominant training method is workplace training for daily tasks and "being low-cost".
- Also the blending of face to face training, self-paced e-learning and is not efficiently used.
- The managers should understand the importance of using other forms of learning like mobile ones, webinars, access to on-demand learning resources and social learning supported by social media.

Some of the reasons of the brain drain of researchers and entrepreneurs are:

- Lack of interest from researchers for making their idea usable for practitioners, for transforming a research result in a practical product and commercialise it.
- Different priorities: for the researcher a publication of an academics paper is important, an entrepreneur's focus is to have success with the business.
- Poor capability of SMEs to recognise the crucial importance of innovation for the sustainability of their businesses.
- SMEs can often not articulate their research needs which could support their business
- Researcher probe new technologies, the boundaries, the problem in connection with them, practitioners have no time to deal with testing.
- Policies focused almost exclusively on the support of transferring of research results to industry (into new products/services or improvements in existing ones) are missing.
- The research interests of academics and industry are often quite different but there are possibilities to support innovation in SMEs i.e. in the form of building innovative business models, tailored services and projects building of cooperation, (European Commission).
- Three approaches supporting innovation and contributing to bridge research institutions and SMEs.



PBL Learning Approaches in SMEs and entrepreneurship education

Problem-based learning-PBL is an exciting alternative to traditional classroom learning. With PBL, the teacher presents you with a problem, not lectures or assignments or exercises. Since you are

not handed "content", your learning becomes active in the sense that you discover, work with content that you determine to be necessary to solve the problem. In PBL the teacher acts as facilitator / mentor, rather than a source of "solutions"

Problem based learning will provide you with opportunities to:

- examine and try out what you know
- discover what you need to learn
- develop your people skills for achieving higher performance in teams
- improve your communications skills
- state and defend positions with evidence and sound argument
- become more flexible in processing information and meeting obligations
- practice skills that you will need after your education

The steps can be repeated and recycled:

Steps two through five may be repeated and reviewed as new information becomes available and redefines the problem. Step six may occur more than once--especially when teachers place emphasis on going beyond "the first draft."

1. Explore the issues:

Your teacher introduces an "ill-structured" problem to you. Discuss the problem statement and list its significant parts. You may feel that you don't know enough to solve the problem but that is the challenge!

You will have to gather information and learn new concepts, principles, or skills as you engage in the problem-solving process.

2. List "What do we know?"

What do you know to solve the problem? This includes both what you actually know and what strengths and capabilities each team member has. Consider or note everyone's input, no matter how strange it may appear: it could hold a possibility!

3. Develop, and write out, the problem statement in your own words:

A problem statement should come from your/the group's analysis of what you know, and what you will need to know to solve it. You will need:

- a written statement
- the agreement of your group on the statement
- feedback on this statement from your instructor.

(This may be optional, but is a good idea)

Note: The problem statement is often revisited and edited as new information is discovered, or "old" information is discarded.

4. List out possible solutions

List them all, then order them from strongest to weakest

Choose the best one, or most likely to succeed

5. List actions to be taken with a timeline

- What do we have to know and do to solve the problem?
- How do we rank these possibilities?
- How do these relate to our list of solutions? Do we agree?

6. List "What do we need to know?"

Research the knowledge and data that will support your solution

You will need to information to fill in missing gaps.

- Discuss possible resources
Experts, books, web sites, etc.
- Assign and schedule research tasks, especially deadlines

7. Write up your solution with its supporting documentation, and submit it.

You may need to present your findings and/or recommendations to a group or your classmates. This should include the problem statement, questions, data gathered, analysis of data, and support for solutions or recommendations based on the data analysis: in short, the process and outcome.

Presenting and defending your conclusions:

The goal is to present not only your conclusions, but the foundation upon which they rest. Prepare to:

- State clearly both the problem and your conclusion
- Summarize the process you used, options considered, and difficulties encountered
- Convince, not overpower
Bring others to your side, or to consider without prejudice your supporting documentation and reason
- Help others learn, as you have learned
- If challenged and you have an answer, present it clearly and you don't have an answer, acknowledge it and refer it for more consideration

Sharing your findings with teachers and students is an opportunity in demonstrating that you have learned. If you know your subject well, this will be evident. If a challenge arises that you cannot respond to, accept it as an opportunity to be explored. However, take pride in your attention to quality when you present. See also the [Guide on presenting projects](#).

8. Review your performance

This debriefing exercise applies both to individuals and the group. Take pride in what you have done well; learn from what you have not done well. Thomas Edison took pride in unsuccessful experiments as part of his journey to successful outcomes!

ICT SUPPORT IN PBL

The European Erasmus+ project "Supporting PBL in entrepreneurial education and in small and medium sized enterprises (SMEs) through ICT facilitated mentoring – Archimedes" will develop a framework for organizational problem-based learning and supports the use of this form of learning.

It is expected that these approaches will be widely adopted in entrepreneurial education and SMEs. PBL will be supported by an ICT platform taking into consideration the PBL steps described below.

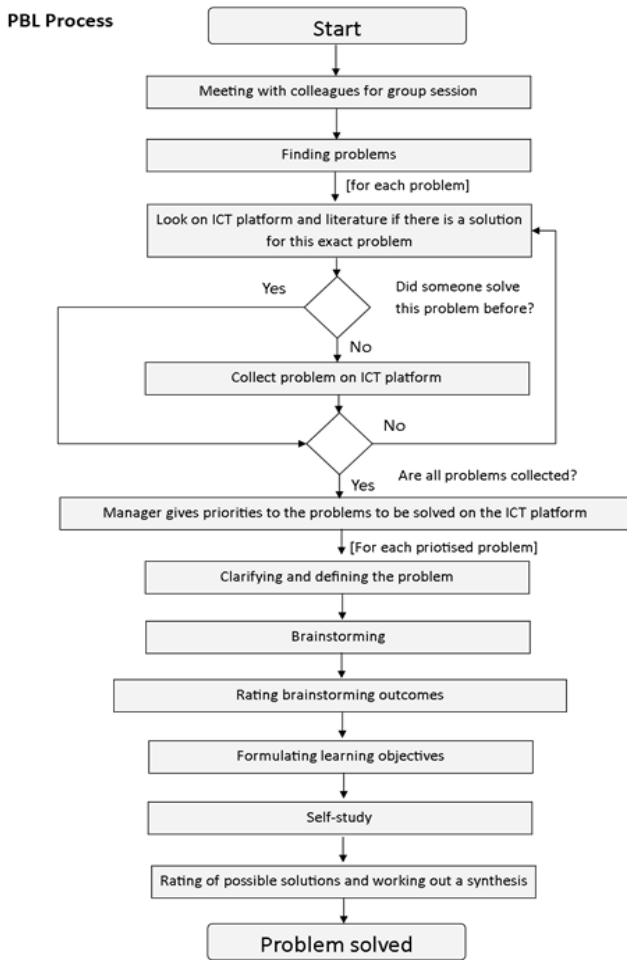


Figure 1. Flow chart of a PBL supporting ICT platform (source IAT)

Step2 - Defining the problem

The problem is that we sold too less printers of the type d4. We wanted to sell 40,000 and only reached 30,000 sold objects. We try to find an improvement of our marketing strategy to increase the amount of sold printers.

Step3 and Step4 - Brainstorming and analysing of possible solutions

Ideas

Idea	Created by	Rating
We invest in advertisement	admin	★★★★☆ (1)
We decrease the price of the printer	admin	★★★★☆ (1)
We enlarge our customer base	admin	★★★★☆ (1)
We observe our competitors	admin	★★★★☆ (1)

Enter an idea

Problem name * Printer sales

Idea *

Created by * admin

Rating Number of votes: 0, Average: 0

Save

Fields marked with an * are mandatory.

Comments

Comment	Created by
We have to take more time to observe the market strategy of our competitors	leana
I think the best strategy is to invest in advertisement	admin

Figure 2. Problem overview on the ICT platform

The platform is in development by using TikiWiki. TikiWiki, also known as Tiki, is an open source Content Management System (CMS). It provides many rich features like websites, forum, chat, wiki, blogs, quiz, calendar, document management, social software and many more.

It is highly configurable and is mainly used in companies to organize tasks and to work collaboratively.

Tiki was used in some of our former project and has proven to be a good ICT solution for collaborative working and will be used as platform for PBL in the frame of the project Archimedes.

The following figures show screenshots of the Archimedes ICT platform supporting PBL. *Implementation of PBL requires some changes in the curriculum of entrepreneurship education and trainers / teachers with special knowledge.*

Rooms should be available for group discussions and the libraries should contain references which allow students to research for their PBL cases.

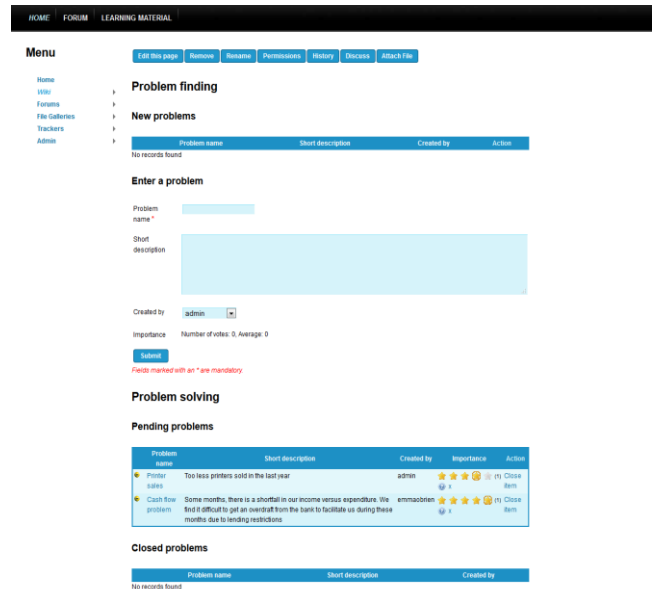


Figure 3. PBL steps visualized on the ICT platform.

Step5 - Formulating learning objectives

Objective	Created by	Action
We have to analyse our competitors	admin	✖
We have to calculate if we can save money for advertisement	admin	✖

Enter a new learning objective

Problem name * Printer sales

Objective *

Created by * admin

Save

Fields marked with an * are mandatory.

Step6 - Self-study

Enter a link or upload a file

Problem name * Printer sales

Link

File(s)

Upload files

Drop files from your desktop here or browse for them

Durchsuchen... Keine Dateien ausgewählt

Comment

Created by * admin

Save

Fields marked with an * are mandatory.

Step7 - Working out a synthesis

Enter the synthesis here

Figure 4. PBL steps visualized on the ICT platform.

Cloud Computing “is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (NIST Definition) **Some characteristics of Cloud Computing are:**

- Cloud computing enables companies to consume compute resources as a utility -- just like electricity -- rather than having to build and maintain computing infrastructures in-house.
- Cloud computing promises several attractive benefits for businesses and end users.
- Self-service provisioning: End users can spin up computing resources for almost any type of workload on-demand.
- On-demand self-service. The user can benefit from capabilities, such as server time and network storage, without requiring human interaction with each service’s provider.
- Broad network access. Capabilities are available over the network and accessed through standard mechanisms
- Resource pooling. The resources are pooled to serve multiple users who generally have no control or knowledge over the exact location. Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.
- Rapid elasticity. Capabilities can be rapidly and elastically provisioned. Companies can scale up as computing needs increase and then scale down again as demands decrease.
- Measured Service. Resource usage can be monitored, controlled, and reported providing transparency for both the provider and user of the utilized service.
- Pay per use: Computing resources are measured at a granular level, allowing users to pay only for the resources and workloads they use.
- A community Cloud is a multitenant infrastructure that is shared among several organizations from a specific group with common computing concerns.

Benefits of Cloud Computing for SMEs are:

- embrace business by using solutions cloud platforms
- grow their business without the need for a new equipment that gets outdated easily.
- take advantages of hosted services it is expected that SMEs will start to make up a larger percentage of cloud adoption trades.

Advantages of the Cloud for SMEs are:

- Up-to-date cloud software solutions without placing too much cost on the business.
- Availability of unlimited data storage from the cloud, which can be expanded anytime
- Access to data from anywhere and anytime means portability and flexibility; giving more time and effort to be placed on business strategies and solutions.

- Sophisticated/high levels of security protocol that ensure business and data protection.
- Better business performance due to the portability, flexibility, efficiency that cloud provides.
- Simplified back-end data management using automatic cross referencing, reconciliation cloud features.

Innovation in the Cloud bridging E-Learning and Businesses IN-Cloud; Results:

- A strategic partnership by building on the potential cloud computing facilitating innovative practices for businesses and universities alike,
- A set of didactic units and a set of VET Qualifications with instruments to validate them
- Learning materials on practical applications of cloud computing,
- A virtual bootcamp as a complementary output with respect to the previous ones.

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