Learning in the workplace for garage mechanics and technicians

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Abstract: Employees in technical firms, like garages, need more and more formations. Due to the very fast innovation in technology, lifelong learning is a real need for these labour forces. On the other hand, there are the needed formations very specialized and expensive. Another problem employers faced in these economical sectors in Western Europe is the lack of candidates. Also in secondary education schools, the wide interest for these formations is decreasing. One of the factors causes this problem is that schools don't have enough money for investing in new and high-tech machines. Therefore two interreg projects were submitted and approved for financing. Interreg is an initiative of the European Union meant for the permanent development of the "European Space". The third phase of interreg means enhancing the economic and social cohesion within the European Union. In this paper, we describe two successful projects, namely Autoweb and V@K, which try to help employers, employees, schools and students to keep up with the high-tech innovations with a workplace-based e-learning program.

Key words: blended learning; cognitive multimedia theory; continuing education; e-learning; garage mechanics; Heating Ventilation Air Condition (HVAC); secondary education; technicians

1. Autoweb: http://www.autowebtraining.eu/

1.1 Project description

Partners in this project are in-service employees of secondary education schools, universities and training centres. This project experiments with partners in several languages: Dutch, German and French. The project starts from employees in garages and wants to offer them a continuing formation on four modules: air conditioning, diagnostic, multiplexing and common rail. The modules are developed in three languages. The theoretical elements are offered through e-learning, using the virtual learning environment ILIAS. Main goal for the use of a VLE (Virtual Learning Environment) for the theoretical part is to make time free for the practical formations. For pupils in secondary education, the developed materials have been adopted to the learning programmes. All partners together have chosen for the practical learning sessions to cooperate with professional learning centers. Not every school has the means to invest in very expensive equipment. Investments for high tech equipment in this project are done by the competence centers.

1.2 Learning materials

The learning materials in this project are very special due to several reasons. The in-service garage mechanics have the possibility to learn at any moment in the workplace. This means that learning packages must be very small and well structured. In European secondary education, lessons are mostly cut in lesson hours for one

hour. This means that regular education students need learning packages to be split up in pieces for maximum forty-five minutes. Due to the technology evolution and its complexity, the learning materials are made in flash with the main goal to have a strong visible effect in learning. The cognitive multimedia theory (Mayer, 2002) explains that learning can be realized not only by written documents. Especially in these branches, the flash animations can contribute to a much more efficient learning by adults and students. All the used flash animations explain to the learners how the high-tech systems work in the automobile sector. Every flash animation is built up in steps, and learners can decide to review again or go further. Every flash animation is however illustrated by the necessary text, which is also written out in the handbook.
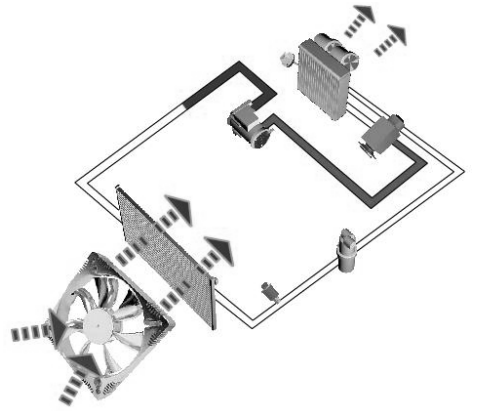

Figure 1   Flash animation air conditioning

These learning materials are published in an electronic learning environment with the main goal to encourage self-directed learning. Therefore an interactive use of the discussion board is strongly recommended. Of course blended learning asks for face to face sessions. These are organized for the students during the regular lessons. For the mechanics the blended learning is divided into a few face to face sessions, e.g. during the start to explain and motivate the students to learn online. For both target groups, a strong emphasis still lies on the practical learning. This is, due to the high-tech evolution, organized in local competence centers. Schools and garages don't have to invest in very expensive equipment, which they can't afford. The competence centers are financed by the Flemish and the Walloon government.

The learning content that has been developed contains air conditioning, diagnostic, common rail and multiplex. For each of these domains specific books have been developed. These books have added value to the electronic learning environment because in European Schools the students have not permanently in every hour and every lessons a pc available. It is already known for a longer time that efficient learning is often better from printed materials than computer screens (Nielsen, 1997). Therefore we made two books, one for the teachers and the other for the students. The books contain a summary which the students can use for studying for their exams. The books also contain instructions to use the electronic environment. Within the electronic environment, it is possible for the teachers to follow up their students. The electronic learning environment has also a lot of tests or quizzes for all the different parts. The quizzes are not meant for an official assessment, but more as a self-assessment-tool for the learners to detect if their learning is still efficient.

1.3 Test cases and results

The project is tested in four secondary education schools in Limburg. In two public and two catholic schools that are Koninklijk Technisch Ateneum II Hasselt, Provinciaal Instituut Limburg Lommel, Technisch Instituut

Heilig Hart Hasselt, WICO Campus TIO Overpelt. The test cases were done in eight classes with seven different teachers and ninety-nine students between seventeen and nineteen years. The project results are so good that the project continues next year. The project has now received the support of the automobile sector. The other Belgian provinces are now invited and allowed to step in the project.

2. V@K: http://www.hvac-leren.eu

2.1 Description of the project

The market of heating, cooling and ventilation installations is a very fast growing market in the build-up areas and town-centres. The economic value of these installations in buildings is still growing as well in percentage as in absolute spent money.

However, the economic branch faces a lack of work forces although the unemployment remains relatively high. So three core-elements have to be realized: occupational resettlement is needed, as well the lifelong learning for already in the sector working people and also increasing the motivation of young students to chose for these professions.

Four university colleges of Belgium and the Netherlands developed course materials to try to develop some steps that could solve the formulated problems. Two high schools and several employees tested the developed learning materials. The content of the learning material was ready and new content was not developed. The partners discussed and researched on how people in the workplace learn about heating, ventilation and cooling installations. One of the needs that was detected was an easily and flexible access to information and learning materials. An electronic learning environment seemed to be a perfect solution. Partners had to research how the content could be offered useful in an electronic learning environment and which content management system fits the best for the project. Some of the partners used already Blackboard or N@tschool, two of the most virtual learning environments in Belgium and the Netherlands. Partners chose several reasons for the CMS (Content Management System) of U&I-learning. Of course the usability was important, but also the service of the company and their references. Because several schools used different CMS's, the partners decided to program the content in flash. All the flash animations are easily to integrate in all the different CMS's, because flash belongs to the SCORM (Sharable Content Object Reference Model) standard. Re-using the developed materials is one of the major new focus elements in projects. Too often was re-developed what had already been made in other projects. Once the CMS was chosen, partners started to develop an approach or didactic for learning in the workplace for employees. "How can employers, employees and students keep up the high-tech innovations in a workplace-based e-learning program" was the main question.

2.2 Problems and solutions

The V@K partners had to struggle with several problems. Mainly the lack of professionals that the employer faces with is too much work and too few employees. But also the fact that due to a lack of professionals, everybody who wants to start with a job in HVAC, has the opportunity, without having the necessary formations or diploma's. This makes the organisation of courses for institutions very difficult. Also the fact that there are a lot of different jobs within the HVAC-market is a serious problem to build out an efficient course program.

2.2.1 Lack of professionals

Because of the lack of professionals, the employees of companies don't have time to study, they have to work. Due to the lack of study-time, within the normal labour-hours, partners have chosen for a blended learning

approach. Employers don't send their employees to general courses anymore. These courses take too much time and time is money. Additionally learners said that the courses were not efficient enough. Sometimes they learned what they already knew. Sometimes the knowledge level didn't fit their needs. So there has to be an approach where the learners just can learn *what* they need and *when* they need. Therefore e-learning seemed to have some opportunities to meet those questions. The learners got access to the content: any time and any place. But during the project, partners detected that learners need more. The best learning results showed that also a personal approach was needed. Online learning can help to learn some details in broader subjects, which learners already know. Learning from scratch in HVAC, only with e-learning seems to be too demanding for employees. This is also already experienced in other subjects. E-learning in this meaning, namely learning by yourself and online has to fit into the learner's learning style. Therefore the learners were invited to come to the training institutions. So blended learning, a blend of face-to-face classes and e-learning was offered. Employees found this necessary.

2.2.2 The content must reach several employees with different kinds of competences and knowledge levels even within the same profession e.g. an installer

All the learners have a different background. Some of them have a master degree, other finished high school. So it was very important to know what they already knew and what their expectations were. The V@K partners developed an internet based question form. The learners filled in their background knowledge and experience and especially what their expectations of the learning modules were. The teacher contacted the learner and discussed further the content of the course, the organisation of the learning course and the applications/installations wherefore the learner needed to keep up with the high-tech innovations. After this personal contact, the teacher knew very well about the goals of the learner.

2.2.3 The engineer, the calculator, the installers have to learn, so different levels have to build out in the e-learning modules

Because of the several degrees and levels of knowledge, the teachers of the university colleges developed the blended learning modules in three levels: high school, bachelor and master degree. So after the personal contact between teacher and learner, the teacher advised the learner which modules were useful.

2.3 Results

Nowadays the blended learning modules are used in very different ways:

(1) In high school, the teacher teaches in class using the modules, so face-to-face. Students have to practice and make the exercises.

(2) In university colleges, the lecturers let the students study on their own. The students get some projects about heating, ventilation and cooling installations. The lecturer is their coach and teacher. There are still, but less face-to-face lessons and the electronic learning environment contains the necessary content with flash animations and also the discussion board. Students are motivated to work and learn together with their peer-students.

(3) Employees of companies mostly choose the blended learning modules. They want a personal approach. There are only a few who chose the e-learning modules, without the service of a coach, but they had already some knowledge about HVAC and considered the course as an additional information source.

During the project, partners learned from each other. The approach in other countries was different. But the partnership grew further. Each partner disseminates the results of the project in their own regions. More schools, universities and organisations wish to use the blended learning modules. A huge network is now established in countries. Schools and companies are setting up some cooperation that is very important for the students, who got nice practices and for the university colleges, they got more research tasks of the companies.

Another advantage was the decrease of costs of the installations. Partners made an inventory of their installations and laboratories. They decided to make use of each others installations. Some university colleges were specialised in cooling other in heating. All these installations are very expensive. So by making use of the installations of our partners, the university colleges, but also the high schools reduced costs. They didn't have to buy all the installations, they could specialise.

Students and employees have confidence in the developed approach. Nowadays more students choose a profession in the HVAC-branch. For the moment there is a growth of fifteen percent. Although fifteen percent is a lot in a short time, it is not enough to maintain, to build all the installations but it's the first step.

Several lecturers of the HVAC-departments at university colleges started to work together. They were all enthusiast to develop new course materials about heating, ventilation and cooling installations. However, the teacher training departments were not involved. All the activities were done based on the HVAC-knowledge of the lecturers. The project team lost many time in the beginning of the project when the CMS had to be chosen. Therefore it is recommended to involve teachers or researchers from teacher training departments to exchange experience and knowledge about teaching and learning with ICT.

At the end of the project V@K, partners developed a business model so that after the funding time the project could still go on. Financial incomes are the registration fees and the sponsor money of the companies.

3. Conclusions

Both cases showed that learning in the workplace can be realized. However learning in the workplace has special requirements, that should taken seriously into consideration. The cost of developing special learning materials, that fits into the needs of these learners are expensive but can surely be re-used in regular education. The project learned that using learning materials developed for learners in the workplace increases the authentic experience for even students in secondary education. This helped to increase the number of students that choose for those professions. The project also learned that e-learning results should not be overestimated. Electronic learning environments have their added value, but the learning style of learners, their already learned content, … are main factors the make e-learning a success. A blended learning approach shows more effective and efficient results. Cooperation between universities, secondary education schools and the work field is strongly advised.

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