EXPERIENCES WITH USE OF ACTIVITY BASED TRAINING METHODS IN HIGHER EDUCATION AND VOCATIONAL EDUCATION AND TRAINING

Tord Talmo, Knut Bjørkli
Sør-Trøndelag University College (HiST) (NORWAY)
tord.talmo@hist.no, knut.bjorkli@hist.no

Abstract
Activity Based Training (ABT) environments, which were developed in the Leonardo da Vinci pilot project Mecca (2005-07), are currently used in vocational education and training within mechanical industry in several European countries.

ABT starts by receiving a technical and economical specification of the product. The product normally constitutes of many small pieces that is developed one by one, and put together into one product. In order to figure out how to construct the product, it is necessary to learn more theory, carry out practical investigations, and provide quality assurance of the components during the production.

During 2011 the methodology has been adapted for use in various types of training environments, such as language training, physics and in welding. This paper is going to outline the pedagogical reasons for the design of the new ABT innovative teaching and learning environment that improve students learning in various types of courses. This has for instance been done by using problem-based learning where students in Norway produced information and promotion material based up on an order from a university in Romania. In Physics the students was assigned the task to build matchstick rockets.

The article will outline the results obtained so far (qualitative and quantitative). The results obtained are based on observations, surveys and interviews of students attending the exemplified projects. Our results and methods are generic, whereby they are applicable to European wide training practices.

Keywords: Activity Based Training, language training, Physics for mechanical engineering.

1 WHY THERE IS A NEED FOR NEW LEARNING ENVIRONMENTS

After a normal lecture, the teacher is often satisfied because the students seem to react positively towards the curriculum being taught. They even say that they have understood, and they go home happy, eager to try on their own, only to figure out that without sufficient guidance, they are not able to solve the topic they have attended a lecture about. This is frustrating, also for the teacher and that is why we at HiST started thinking differently about how, where and why we teach. There is no point having lectures where the students are not able to draw what they are supposed to from the curriculum. Our answer has been to build two digital learning laboratories, dividing the students into smaller groups, giving them access to new technology and enabling them to solve varied and differentiated problem based tasks under the guidance of qualified staff, who function as facilitators more than lecturers.

When we look at higher education in Norway today, there is one feature that seems to be the medicine towards increasing efficiency, and that is bigger groups, fewer lectures with more curriculum per minute taught and more curriculum per point achieved in the study. This seems like one way to go, the only problem is that it does not work, because most of the students do not like this kind of learning, and therefore do not learn as much as they should during their years at university or university colleges. At primary and high schools the trend seems to be the same, at least according to the PISA and PIRLS reports, placing Norwegian students in the bottom according to test scores in the subjects mathematics, science subjects and reading. [1] At HiST, Department of Technology, we have started to move in a different direction, towards smaller groups and more activity based training. According to Peter Blatchford collaborative work gives good effects with regard to learning. [2]

This also includes using mobile learning technologies to enhance communication and interaction in class, by using the new online HiST Student Response Systems (SRS). SRS are currently disseminated to Romania, Sweden and Portugal through the ongoing GlobalSRS project [3].
Instructors get instant feedback on how well the students are paying attention to a training session, while students get instant feedback on their understanding of key concepts.

Furthermore, it also includes developing and using new assessment for learning methods and system solutions that may be combined with the SRS. Such Peer Learning Assessment Systems (PeLe) may be used in combination with SRS [4]. The teacher may use SRS as a tool to provide verification or elaborative feedback immediately after completion of test and exams to single students or groups of students. PeLe is currently tested in Sweden, Slovenia, Romania, Hungary and Norway.

In order to provide more practice-oriented training has the Activity Based Training (ABT) methodology been developed. Though it was originally developed in the Leonardo da Vinci Mecca project [5], it is today deployed into new disciplines. One of the latest extensions is for instance joining of plastic materials, which is highlighted in the ongoing EuroPlast project [6]. The main aim is to expand learning skills by use of ABT, and disseminate the inquiry- and problem based blended learning training methods into Slovenia, Slovakia, Hungary and Norway.

This paper reports achievements obtained and discusses relevant issues according to use of ABT methodology in higher education, using examples from two different subjects; Physics and Norwegian Language Training. The paper presents results obtained through interviews, surveys and observations done by staff at HiST. At the end it is pointed out the direction for further research and development of the methodology.

2 DIGITAL LEARNING LABS

To be able to work in new ways HiST has designed and developed new learning environments, i.e. Digital Learning Labs. Throughout 2011-2012 the digital learning labs have been used in different ways. There are some general advantages these rooms give contrary to other learning environments.

![Figure 1: Pictures illustrating the different solutions used in digital learning labs at HiST.](image)

This paper shows that the main advantage with the digital learning labs is that they give an exciting way of collaborative work. Students group together in five or six with one common table and a SMART Board in front of them. The SMART Board functions as a common point of focus, making the students work together with the problem instead of by themselves. The students function as a group, instead of as single students just working in a group.

In two of the groups chosen for experimentation in 2011, one physics class and one class in language training, we have used these labs to utilize a methodology called Activity Based Training (ABT), from a model developed through the Mecca project, coordinated by HiST. The model is closely related to modern businesses and how they work.

3 ACTIVITY BASED TRAINING – A SHORT INTRODUCTION

According to the ABT model there are four basic components to be considered: 1) Specification of a product as an order, 2) applying an ABT methodology to ensure that theoretical training is immediately applied into practice, 3) interactive training utilizing students’ own Smartphones and 4) extended use of multimedia material to enhance self-paced online education. [7]
Figure 2: A "snake", showing how the students should work with an ABT problem

The basic idea is that the students through ABT will get more motivated to also learn theory during the process. Whenever they get to a problem, they will be forced into seeking explanation in theory. This provides good synergies between practice and theory. [8]

3.1 ABT in Language Training

In Autumn 2011 we wanted to try the methodology in a theory based subject, Language Training. We decided to use four weeks, including one week where the students had a vacate week, to test the ABT in one class within the subject of commercial theory. The main aim was to improve their motivation for commercial theory, and also for Norwegian in general. The next part of the article will explain the process, and point at different experiences throughout the project.

When we look at how we utilized ABT in working with commercials it was basically nine steps to be considered.

1. External order from a customer
   The student group got a customer request, delivered from Rumania, for promotional material; a video clip, a leaflet and a web-page, aimed at recruiting Rumanian students to Norway through the Erasmus exchange program.

2. Introduction
   The student group was split in half, giving us two commercial bureaus of approximately 30 students each competing for the job. They were given access to the digital learning labs, within the frames of the University College’s time table, the students time table and the other subjects the students attended, and external resources, both technical and human resources, in form of qualified staff. There were at least two subject teachers present in every lesson used for the project during the four weeks it lasted, as well as several others observing, giving advice and collecting data. The subject teacher appointed one group leader in both groups, and then the students took control.

3. Planning
   According to the ABT-method, there were some guide lines the students needed to follow. First of all, they had to divide into sub groups to be able to finish all the different tasks. They also appointed one leader in each sub-group to be included in a project management group of four students. The rooms are designed for exactly this kind of work. Easily the group can divide the room into six small rooms, and by drawing the curtains they can include all the smaller groups into a whole. The curtains also lower the sound, both from video clips and discussions, making the lab a good place to work in.

4. Documentation
   During the project, the students were given a work pack, consisting of different documents they had to write, different meetings they had to lead and participate in and different deadlines they had to fulfill. This led the students into a state where they needed to learn theory, which were given to them in short lessons led by the subject teacher during the whole period. This was also the case
when they were to put all the different products into one before the final presentation via video conference to Rumania. They saw the need for commercial theory, to outline a symbolic, coloristic and theme based promotion, were all the elements corresponded with each other. Some of this curriculum was given to them through lectures, some they found out on their own, but most of it they obtained through discussing actual problems with one of the subject teachers or other students, relating it to their own product.

5. Technical Fabrication

Both groups quickly decided on using Words brochures, World press as web-page and Movie Maker as the editing program for the video clip. One aim of the project was that students should focus on curricula more than technical solutions. The students showed extended knowledge about the technical side, which enhanced the focus on curricula.

6. Customer Assurance

During the project weeks, the bureaus had to contact the customer twice for customer verification. Before the meetings the groups sent a status report to the customer. The meetings were held via video conference, forcing the students to explain and outline the problems in a different language than their mother tongue. They were given the opportunity to put up their products on one SMART Board whilst the customers were on another. Through discussions they agreed on how they should progress. The groups took into consideration the customers marks and tried to develop the products in the direction he wanted.

7. Fabrication

After meeting with the customer the groups worked on implementing his ideas into the products, gathering the required amount of information, highlighting the important aspects of the commercial and proofreading everything. This was the hardest part for the students, struggling to keep motivated, keeping the groups together and finishing a good product to deliver to the customer. This was also the part of the process were the subject teacher was most involved, directing the groups in the right direction, and explaining theoretical aspects the students wondered about.

8. Refining

In the last week, we used SRS to figure out which of the products were the best. The last couple of days, the two groups worked together refining and validating the products as one group. This was a way of making the whole class a part of the final product, giving them a sense of ownership to the final product. The group also designed adds were they sought for experts within the fields of brochure making, web and video, so that the products could be made in a more professional way after the project was finished. This was a way to ensure the quality of the product towards the customer.

9. Product delivered to customer

In the work pack, there were specific elements the students had to deliver, including formal documents like a contract, papers for meetings, minutes, notes and ads. The students delivered this together with the final products, and had a last meeting with the customer. The products were approved, and should be directly applicable in promoting HiST towards Rumanian students. This is a vital part in the ABT methodology, showing the students that what they deliver will in fact be used outside school, which again increases student motivation.

The final products presented to the customer were approved, and all the involved parts were more than satisfied with them. Everything is uploaded on the web page that can be viewed from the online address:

http://mej.no/project

3.2 ABT in Physics

The first version of the digital learning labs was run as a pilot for mechanical engineering students following an introductory physics course autumn 2010. At this stage, we wanted to study the effect of the learning labs themselves, and so all other parameters – including the exercise done by the students – were kept constant. In other words, the course material and student assignments were exactly the same as the previous year. In the end-of-year evaluation, the students were positive to the use of the learning labs, but pointed out that the full potential of the learning labs could only be realized if the exercises were modified to reflect the possibilities that the labs offer. To this end, the course material for autumn 2011 was modified: «It is important that the task is set up in a way that
encourages all members to talk and work together, and does not actually encourage individual working." [9] The assignments were revised to put a much stronger emphasis on problems designed to be solved as a group effort.

Figure 4 shows the results of a survey done at the end of the term in 2011, among mechanical engineering students following the revised physics course. It is clearly indicated that the students see the group aspect as the most important when working in the digital learning labs.

![Pie chart showing survey results](image)

**Which aspect of working in the digital learning labs is most important to you?**

- Working in a group: 54%
- Discussing physics with fellow students: 36%
- The technology offered by the rooms: 6%
- The exercises/assignments: 3%
- I have no opinion

Figure 3: Answers given by students (n=70) at the end of the semester 2011

It also seems that we hit the correct level of difficulty with the assignments given, as shown in Figure 5. 84% of the students think that the assignments given are just about right when it comes to difficulty.

![Bar chart showing difficulty ratings](image)

**How would you rate the difficulty level of the exercises?**

- Much too difficult: 3%
- A bit too difficult: 13%
- Just about right: 84%
- Too easy: 0%

Figure 4: Answers given by students (n=70) at the end of the semester 2011

As an experiment, the physics class of 2011 was presented with an ABT-problem, in the form of a physics assignment from an external contractor, a professor in mechanical engineering from Romania. Their task was to design a rocket from matchsticks and aluminum foil, in such a way so as to maximize the horizontal range of the rocket. The students also had to perform various calculations related to the rocket trajectory (e.g. estimating the initial speed of the rocket at launch). To stimulate student motivation, the process was made into a contest, where the team whose rocket went furthest would be allowed to present their design to the customer, who would award a prize to the winning team.
Working in groups of 4-5, the digital learning labs were used by the students to plan a rocket design that would meet the specifications. The students had to produce written documentation for their design (calculations; design sketches; considerations done to meet production specifications). They were also asked to produce a video of the design process, and the launch of their rockets. Because of restraint on time, the students skipped the steps Technical Fabrication and Customer assurance, and went directly to the fabrication of the rocket.

All students were given the same materials from which to construct the rocket: matches, aluminium foil and a paper clip for a launch pad. The students launched their rocket prototypes, and made adjustments to the rocket design and the launch pad to maximize the horizontal range of the rocket.

The winning group presented their rocket design to Professor Moldovan. The students had to outline their design considerations, and also answer questions from Professor Moldovan.

![Figure 5: Pictures illustrating the ABT process in physics, in which matchstick rockets were produced](image)

4 RESULTS

Results obtained so far are positive. After ending the commercial project in Language training, we performed interviews with two separate groups, asking them about mainly three things; 1) The ABT-methodology, 2) the digital learning labs and 3) learning outcome from the project.

With regard to the ABT-methodology they all agreed that this was a good way to learn curriculum. They had a sense that more students worked longer hours, having more interest in the subject because it was an actual product that was going to be delivered to a customer. They also saw the effect of collaborative work, in that they also learned elements like project management, the importance of being organized through documentation and how all details are important in the end.

When it came to the Digital Learning Labs they were mainly satisfied with the infrastructure, and they claimed that this experiment would not have been possible within the normal facilities at HiST. They did not use all the technical equipment, but relied to some extent on their own equipment. Nevertheless they enjoyed and made good use of the SMART Board as a common area of focus.

When it came to learning outcome, some of the students claimed to be surprised by how much they had learned:

> And that was magnificent, and I have not really, has not actually thought about the value of, of the project before we in a way came, before we in a way were supposed to have the commercial part also, then I thought like, I know that [...] And I get a lot of stuff, surprisingly (agrees), I do, I have to say.

The students learned a lot from working in groups, with the subject teacher as a facilitator that taught for less time, and used more time on each group, directing each sub-group in the direction that would work best.

The same trend was observed in physics for mechanical engineering students. In the end-of-term survey, many students emphasized the positive learning effect of the ABT-experiment. As shown in Figure 7, 76% of the students reported that the overall impression of the learning labs was “excellent”, and some 97% of the students gave the use of digital learning labs an above-average rating.
5 CONCLUSION

The experiments done with and inside the digital learning labs are all together very positive. Our results, both quantitative and qualitative, also show that the ABT methodology works, and gives a learning outcome which is at least as good as ordinary lectures. This paper also affirms that the ABT methodology can be used universally – it works equally well in Language Training and in Physics.

We have also identified certain issues with the digital learning labs that need to be addressed. So far, group sizing and group composition has been done in a fairly random way. This, augmented by a limited amount group coaching by the teacher, has made some groups less then effective (e.g. one student ending up doing all the work). We therefore need to look further into how the teacher can control the group processes in the labs; group sizes; task design (which type of assignments and exercises should be used), and goal orientation, concerning both curricula and technology usage. Another aspect is that, because students are so positive towards working in the learning labs, there’s a danger they will neglect other subjects – so time management needs to be addressed. The students themselves have highlighted the need for project management training (including time management) before starting ABT projects – which tend to be quite time-consuming.

The results obtained so far are based on preliminary experimentation, no full scale research. In order to do even more robust statistical inferences, we will continue doing research on digital learning labs and ABT methodology – in particular, we would like gather more data from control groups who are not using the digital learning labs, for cross-referencing.

ACKNOWLEDGEMENTS

These results have been obtained with support from the European Commission. This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use, which may be made of the information contained therein.

REFERENCES


[4] The Done-IT project, 2012, online at www.histproject.no. This is a LLP KA3-ICT project, which is cofounded by the European Commission during the period 2011-12. Contract 511485-LLP-1-2010-NO-KA3-KA3MP
[5] The MECCA project, 2005-2007, online at www.histproject.no. Contract N/05/B/F/PP-165.014, which was cofounded by the European Commission during the period 2005-07.


