ENGLISH SUMMARY

This report summarises the results of a valorisation of the Finnish Leonardo projects. The aim of the valorisation was to analyse, point out and disseminate further the pedagogical and technological innovations in Finnish vocational education, created in the Leonardo projects.

The valorisation was conducted in the following order:

1. analysis of the current state-of-the-art; meta-analysis of previous evaluations related to pedagogical and technological development projects, and the current level of expertise within the Finnish vocational education system;
2. definition of criteria for pedagogical and technological innovations; it was based on an analysis of the current situation (phase 1) and on some new pedagogical theories;
3. selection of 21 Leonardo projects; selection was based on the criteria;
4. evaluation of the outcomes and products; it was based on documents, interviews and an analysis of the products;
5. workshop with project representatives and experts; discussion based on preliminary results;
6. adjustment of analysis methods and results according to feedback;
7. presentation of the results in an invitational seminar; and
8. report writing.

Current state-of-the-art

Several evaluations suggest that in the Finnish vocational education system, the use of modern technology is very well supported by a good infrastructure. Schools and universities usually have a good number of computers available for students and teachers, good access to the Internet and satisfactory data networks.

However, good technological infrastructure does not guarantee that teachers are able and willing to use modern technology in teaching. Use of technology is often limited to more active teachers and to the odd teaching experiments, which are rather isolated and therefore less effective for the educational system as a whole. Usually, the experiments also lack pedagogical insight, and therefore produce technologically advanced yet pedagogically less innovative outcomes.

The level of pedagogical formal training for vocational teachers and trainers varies a great deal. In polytechnics and in vocational schools a formal degree in pedagogy is required, but in other levels (universities, vocational training centres, working life organisations) there are no such regulations, and thus the pedagogical skills of the teachers and trainers are more heterogenous.

Criteria for innovations

Based on the current state-of-the-art, a list of criteria was defined both for pedagogical innovations and technological innovations. Additional criteria were created to analyse the projects and outcomes in terms of dissemination, transferability and use of the end products.

Pedagogical criteria are based on the analysis of pedagogical literature; modern learning theories and pedagogical models which could be used to develop further vocational training were analysed, and the key elements of “good learning” were collected as criteria. The list of theories
and models was also used in the evaluation of the end products, to analyse whether advanced pedagogical tools and models had been used in the projects. The models and theories were: the cognitive learning model (Engeström 1988), constructivism (eg. Duffy & Jonassen 1992), Self-Directed Learning, Open and Contextual Learning Environments (Kauppi 1995, Manninen 2000), Web-based Learning Environments and Computer Mediated Communication (eg. Paulsen 1995, Matikainen & Manninen 2000), Collaborative Learning (Johnson & Johnson 1987), Problem Based Learning (Hakkarainen & al. 1999), Transformative Learning (Mezirow 1991), Developmental work research and Activity Theory (eg. Engeström 1999), Project Based Learning (Miettinen & al. 1999), Learning at Work -approaches, and models based on Cognitive and Collective Development of Expertise (Bereiter & Scardamalia 1993, Lave & Wenger 1991).

The criteria for pedagogical innovations are described below:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Ordinary</th>
<th>Innovative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructiveness</td>
<td>Teaching does not pay much attention to how the subject matter is integrated in the existing knowledge structures of the student</td>
<td>Teaching and learning are clearly based on the learners’ active construction process and on the creation of higher level knowledge structures</td>
</tr>
<tr>
<td>Activeness</td>
<td>Learning environment does not support nor require the learner’s own active role in the learning process</td>
<td>Learning environment is based on the learner’s active role and commitment</td>
</tr>
<tr>
<td>Cooperativeness</td>
<td>Learning takes place mainly alone</td>
<td>Learning is based on co-operative and collaborative principles and takes place in groups</td>
</tr>
<tr>
<td>Contextuality</td>
<td>Learning takes place in an institution and/or is separated from the concrete situation of application of the knowledge</td>
<td>Learning takes place in a simulated or real-life situation, which equals the actual context where the knowledge will be applied</td>
</tr>
<tr>
<td>Problem based</td>
<td>Study objectives are based on study subjects in a traditional way, and cut into separate units in the curriculum</td>
<td>Learning approach is problem based and investigative</td>
</tr>
</tbody>
</table>

Criteria for technological innovations were based mainly on research on educational technology, and the emphasis was on the “human – technology” interaction as well as on technology mediated “human – human” interaction. The technological solutions were evaluated by analysing what kind of interaction is possible with the technology and via the technology. Also, use of multimedia applications and solutions, allowing individual learning paths, were considered innovative. The criteria are defined below:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Ordinary</th>
<th>Innovative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactivity</td>
<td>Tools developed in the project are mainly based on passive receiving of information (video, tv, www-pages)</td>
<td>Tools are based on interactive technology (interactive video, interactive www-pages, learning programmes)</td>
</tr>
<tr>
<td>Communicativeness</td>
<td>Tools allow only one-way messaging</td>
<td>Tools allow many-to-many-type communication</td>
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<td>-------------------</td>
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</tr>
<tr>
<td>Individuality</td>
<td>The learning process using the tools will be similar for all the users</td>
<td>The tools make it possible to create and follow individual study paths</td>
</tr>
<tr>
<td>Multimedia</td>
<td>The product is based on a single tool</td>
<td>The product is an innovative combination of alternative tools supporting each other</td>
</tr>
</tbody>
</table>

In www-based products the level of solution (Manninen 2000) was analysed. Level 1 solutions simply use the Internet and the www as a distribution channel and linear text documents, Level 2 (also) makes interaction and communication possible, Level 3 has structured hypertext elements and environments which aim to direct the learning process, and Level 4 solutions provide a whole Learning Environment, for example, with different tools, discussion areas and course management tools.

Other criteria were based on objectives of the Leonardo programme, and on the appraisal of the added value of working together internationally:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>ordinary</th>
<th>⇄</th>
<th>good idea</th>
<th>⇄</th>
<th>innovative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissemination</td>
<td>not done</td>
<td></td>
<td>some dissemination activities have taken place</td>
<td></td>
<td>Actively disseminated and marketed to own and other organisations</td>
</tr>
<tr>
<td>Role of the EU-cooperation</td>
<td>“well, we did it ‘together’”</td>
<td></td>
<td>Working together had some added value; “we also learned something”</td>
<td></td>
<td>Cooperation was the primus motor for the innovation to come true</td>
</tr>
<tr>
<td>Use of the product</td>
<td>left on the shelves when the project ended</td>
<td></td>
<td>still in use in the same place</td>
<td></td>
<td>has been distributed to other places as well</td>
</tr>
<tr>
<td>Transferability</td>
<td>Expensive technology which is difficult to access; many resources and special skills required by the teachers</td>
<td></td>
<td>Moderately priced and accessible technology; pedagogical innovation which only requires some additional resources</td>
<td></td>
<td>Moderately priced and easy-to-use and accessible technology; pedagogical innovation which is easily adopted using normal resources</td>
</tr>
</tbody>
</table>

**Results**

The end products were clearly divided into three different groups.

**Technological solutions** were products, where modern information and communication technology were used in relatively traditional teaching and learning contexts. Technological innovativeness was therefore high, but pedagogically the products were rather ordinary.

**Pedagogical tools and models** emphasise more the pedagogical innovations, creating rather good pedagogical solutions and new methods for teaching and learning. Technology is used either in a rather limited or in a ordinary way, and some end products were completed without any technology.
Between these there were **learning environments**, where both technological and pedagogical innovations were used to create technology-supported modern learning environments, usually using Internet and www technology.

The main results can be summarised as follows. When pedagogical innovations were considered, it can be said that:

- the quality of the product is better, if it is clearly based on some pedagogical model and on a particular learning theory;
- even though some theoretical principles can be seen behind the products, only a few of them are based on a particular pedagogical theory on purpose;
- the good pedagogical models which are available, and could be used in vocational training, were hardly ever used in the projects;
- therefore, the products cannot be considered as innovations, because they do not use modern learning theories and pedagogical models; and
- the general strengths usually are contextuality and problem-based approaches, and many products have collaborative and constructive elements. However, these could be used in a more conscious and systematic manner.

Use of technology can be summarised as follows:

- the main technology used in the projects is the www, CD-Rom, and simulations/3D virtual reality;
- the www and Internet solutions apply all levels, which means that Level 1 linear text solutions are also used (but not as the only means of teaching and learning);
- technologically most advanced are some solutions using 3D virtual reality, which have been used to simulate different production processes. Some high quality multimedia products have been created as well;
- not all technological solutions can be considered as innovations, because they are usually based on rather ordinary technology. On the other hand, in some cases a lower level of technology has been a conscious decision, which better enables dissemination in countries where the technological infrastructure is less advanced;
- the level of technological infrastructure and skills vary from one country to another, which in some cases makes it more difficult to cooperate and disseminate the outcomes. Therefore, from the Finnish point of view, the level of technological innovations is not as high as it could be;
- technology is not always selected using pedagogical arguments, but to guarantee wide dissemination or simply because the particular technology is available; and
- funding is often used to develop technology instead of pedagogical training of the teachers; however, a pedagogically sound use of that technology depends on the teacher’s ability to use it.

Other observations can be summarised as follows:

- establishment of personal contacts and networks is considered as an especially valuable side product; these encourage an exchange of ideas, creation of ideas, cooperation and integration of international dimension in all activities;
- in some projects there are examples on how good pedagogical and technological solutions move from one country to another; and
- cooperation is usually more effective, if the consortium have (1) existed prior to the project idea, or (2) built on purpose by contacting the relevant partners.
Cooperation with the working life is usually useful:

- projects which are based on the needs of the working life, and which are done in cooperation, usually produce good products and outcomes;
- representatives of the working life usually make the end products more contextual and more problem-based; and
- in some cases the business partner’s commercial interests and need for secrecy make it more difficult to disseminate the products (eg. tailor-made products, commercial copyrights)

In general it can be stated that:

- many good pedagogical and technological development projects would not see daylight without Leonardo funding;
- the added value provided by Leonardo funding is usually in the creation of networks and international contacts;
- Leonardo projects legitimise developmental work in the organisations and therefore support pedagogical development;
- however, administration and bureaucracy take too much time from the actual work.

Conclusions and recommendations

General recommendations related to the development of the vocational education system in Finland are the following:

1. In order to make full use of the possibilities provided by new learning environments and modern information and communication technology, these should be better taken into account in the pedagogical training of teachers.
2. All development projects should include both technical, pedagogical and content-related expertise.
3. The outcomes of the EU projects could be developed further in national dissemination projects.

Recommendations in relation to pedagogy are the following:

1. Learning theories and different pedagogical models should be used in the new projects in a systematic manner.
2. One criteria for funding could be that pedagogical expertise is available within the project as well.
3. Project plans and budgets should take into consideration how the teachers learn to work with new pedagogical models and in new technology-supported learning environments.
4. National or EU funding could be directed to continuation projects, where technologically-innovative products are developed further pedagogically (eg. training of teachers to use the end product, development of pedagogical principles behind the product).
5. Teacher training should be developed so that teachers and training organisations have better qualifications to use and develop modern pedagogical models and new learning environments.

It is recommended that when technology is used in education:

1. Www -products should be higher level solutions instead of services which use linear texts and information searches.
2. Technological decisions and solutions should also be pedagogically based.
3. Planning of projects should take into consideration the differences in technological infrastructure in different countries.
4. Usability should also be considered when technological decisions are made (eg. limitations caused by speed and expenses in international data connections).
5. Special dissemination funding should be available to develop further good and innovative pedagogical models and methods, to include some technological aspects as well.

Relations to working life organisations:

1. Representatives of working life organisations should always be within the partnership, and their role and input should be clearer.
2. The projects should take into consideration and support the integration of end-products into the activities of the partner organisations (enterprises and training organisations).
3. It should be guaranteed that the objectives are needs-based.

Recommendations related to project management and international cooperation:

1. Bureaucracy related to funding should be reduced and made more simple, in order to allow more resources for the actual development work.
2. Arrival of funding on time should be guaranteed, in order to make it possible for partners without “buffer funds” to participate and function properly; this is especially vital for private enterprises, and therefore related to the development of relations between the training system and the working life.
3. More attention should be paid to how and on what grounds project partners are selected.
4. The added value and objectives of international cooperation should be evaluated and justified already in the application stage.
References


Appendix 1.

Projects selected for valorisation:

Projects coordinated by Finns:

<table>
<thead>
<tr>
<th>No.</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FIN/95/2/1704/PI/II.1.1.c/FPC</td>
<td>European Collaborative Learning Environment (ECOLE)</td>
</tr>
<tr>
<td>2</td>
<td>FIN/95/2/1091/PI/II.1.1.a/CON</td>
<td>Integrated Open and Distance Learning Programme for the SMEs in the European Graphics Industry (IDOL)</td>
</tr>
<tr>
<td>3</td>
<td>FIN/95/A/10/PI/III.1.a/FPC</td>
<td>Multiformat Open and Distance Learning Technical and Business English Programme (MTBE)</td>
</tr>
<tr>
<td>4</td>
<td>FIN/95/A/22/PI/II.1.1.a/FPC</td>
<td>Common European Studies in Multiple Use of Forests and Forest Environment (Multiple Use of Forests)</td>
</tr>
<tr>
<td>5</td>
<td>FIN/96/1/03041/PI/II.1.1.a/CON</td>
<td>Virtual Factory for Education (Virtual Factory)</td>
</tr>
<tr>
<td>6</td>
<td>FIN/97/1/27020/PI/I.1.1.a/FPI</td>
<td>Network Based Project Learning in Engineering Education (NetPro)</td>
</tr>
<tr>
<td>7</td>
<td>FIN/95/A/1/PI/II.1.1.a/FPI</td>
<td>Teaching Chemistry by Vegetable Oil Theme (Biodiesel)</td>
</tr>
<tr>
<td>8</td>
<td>FIN/95/2/1218/PI/II.1.1.a/FPC</td>
<td>The Development of Quality Guide and Multimedia Training Program for Hotel Industry (Quality Guide)</td>
</tr>
<tr>
<td>9</td>
<td>FIN/95/2/2921/PI/II.1.1.c/FPC</td>
<td>Special Training for Environmentally-sound Production (STEP)</td>
</tr>
<tr>
<td>10</td>
<td>FIN/96/2/0435/PI/II.1.1.c/FPC</td>
<td>Development of Fieldbus Training (DEFITRA)</td>
</tr>
<tr>
<td>11</td>
<td>FIN/96/2/0600/PI/II.1.1.a/CON</td>
<td>Developing Multi-skilled Technician and Lifelong Learning (Multi-skill)</td>
</tr>
<tr>
<td>12</td>
<td>FIN/98/1/67013/PI/III.1.a/CONT</td>
<td>A Teacher/Institutional Diagnostic and Development Programme for the Introduction of Content and Language Integrated Learning (VocTalk)</td>
</tr>
<tr>
<td>13</td>
<td>FIN/95/A/40/PI/I.1.1.b/CON</td>
<td>(Hamlet Archive and) Multimedia Learning Environment for Theatre (HAMLET)</td>
</tr>
<tr>
<td>14</td>
<td>FIN/98/1/67030/PI/I.1.1.a/FPI</td>
<td>Media and Ethics (Medet)</td>
</tr>
</tbody>
</table>

Partner projects:

<table>
<thead>
<tr>
<th>No.</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>IRL/96/4260/PI/I.1.1.a/</td>
<td>Personalisation of Training Courses</td>
</tr>
<tr>
<td>P2</td>
<td>S/95/2/1280/PI/I.1.1.a/FPI</td>
<td>Computer Aided Training System for Bookbinding, Finishing &amp; Mailing Areas (PostPressSIM)</td>
</tr>
<tr>
<td>P3</td>
<td>IRL/97/2/00696/PI/I.1.1.a/FPC</td>
<td>Training of Facilitators in Learning by Open Learning Systems (Trails)</td>
</tr>
<tr>
<td>P4</td>
<td>D/97/1/12008/PI/III.3.a/FPC</td>
<td>The Delta Concept (DELTAT)</td>
</tr>
<tr>
<td>P5</td>
<td>UK/97/1/37036/PI/III.3.a/FPC</td>
<td>European Regional Education Network (EREN)</td>
</tr>
<tr>
<td>P6</td>
<td>S/96/240/PI/I.1.1.a/</td>
<td>Benchlearning - advanced organisational learning</td>
</tr>
<tr>
<td>P7</td>
<td>D/96/1/01063/PI/III.3.a/FPC</td>
<td>Multimedia Learning and Information Systems in CVT: A European Train-the-Trainer Concept (MM-Euro)</td>
</tr>
</tbody>
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