Contract number:	42936
Project acronym:	POPBL
Project title:	School Science Teaching by Project Orientation – Improving the Transition to University and Labour Market for Boys and Girls
Instrument:	SSA
Thematic Priority:	Science and Society

Publishable Final Activity Report

Period covered:	01.10.2006 – 30.09.2008	**Date of preparation:**	23.12.2008 18.02.2009 24.09.2010 20.10.2010
Start date of project:	01.10.2006	**Duration:**	2 years

Project co-ordinator name: Prof. Maria Krüger-Basener

Project co-ordinator Organisation name: Hochschule Emden/Leer University of Applied Sciences, Germany

Final version 1

Maria Krüger-Basener ■ Michael Schlaak ■ Inga Scheumann ■ Hayo Siemsen ■ Antje Gronewold and Project Partners[1]

School Science Teaching by Project Orientation - Improving the Transition to University and the Labour Market for Boys and Girls - Executives Abstract

The Project "School Science Teaching by Project Orientation - Improving the Transition to University and the Labour Market for Boys and Girls (POPBL)" within the Sixth EU Framework Programme for Research and Technological Development aimed to show new ways of how to foster pupils' interest in science by school science teaching.

The consortium consisted of 18 partners with different expertise -including six universities, eleven schools and one Ministry of Science and Culture.

	Organisation name	Participant	Expertise for the Project
D	Hochschule Emden/Leer (former Fachhochschule Oldenburg/Ostfriesland/Wilhelmshaven)	Maria Krüger-Basener	University of Applied Sciences: Coordinator (Technical Department); POPBL teaching for University Students
D	Ministry of Science and Culture, Lower Saxony	Barbara Hartung	Gender Expert
D	Integrierte Gesamtschule Aurich West	Kai-Dieter Hoop	Comprehensive Modern Secondary School (science classes)
D		Dirk Wübben / Rita Cierpka-Gröger	Comprehensive Modern Secondary School (Physics, Chemistry) mono-educative science classes
D	Ernst-Abbe-Gymnasium Eisenach	Dirk Haskarl	Classical Grammar School (Physics, Chemistry)
E	Humanities and Education Science Faculty, Mondragon University	Miren Arantzazu Irigoras / Xabier Arregi	University: Expertise for Science Teachers Education (Chemistry)
E	Pasaia-Lezo Lizeoa Irakaskuntza Kooperatiba Elkartea	Mikel Etxaniz	Modern Secondary School – Textbook Author (Physics, Chemistry)
E	Arizmendi Ikastola	Maria Arantza Exteberria / Illart Azkarate	Modern Secondary School (Physics, Chemistry)
DK	Esbjerg Tekniske Institut, Aalborg Universitet	Torben Rosenörn / Birgit Kjærside Storm	University of Applied Sciences: Experts for POPBL teaching (Biochemistry)
DK	Friskolen i Bramming	Ole Korsholm Nielsen / Camilla Bjerregaard	Traditional Private School
CZ	Ceske vysoke uceni technicke v Praze (Czech Technical University in Prague)	Herman Mann	University: Expert for Projects with Simulation Software (Computer Science)
CZ	Gymnasium Praha 6 Arabska 14	Zdenka Hamhalterova	Grammar School (Physics)
FIN	Keski – Pohjanmaan ammattikorkeakouluosakeyhtiö (Central Ostrobothnia Polytechnic University of Applied Sciences)	Maija Rukajarvi Saarela	University of Applied Sciences: Expertise in Science Teachers Education (Chemistry)
FIN	Kalajoen kaupunki (Kalajoen Lukio)	Päivi Olaja	Comprehensive Secondary School (Physics, Chemistry) Textbook Author
FIN	Kokkolan kaupunki (Kokkolan yhteislyseon lukio)	Teemu Känsäkangas / Tuula Heikkila	Comprehensive Secondary School (Physics, Biology)
RO	"GH Asachi" Technical University of Iasi	Costache Rusu	University: Expertise in Quality of Higher Education (Textile)
RO	Ioan C. Stefanescu School Cluster	Liana-Dolores Voinea	Textile College (Physics, Chemistry)
RO	Technical College „Petru Musat“	Maria Teodoreanu	Technical College for craftsmanship (Physics)

Table 1: Participants list – sorted by country

[1] *Project Coordinator: Prof. Maria Krüger-Basener, Hochschule Emden/Leer*, krueger-*basener*@technik-emden.de

1 Initial Situation and Project Aims

Young people's interests for science and technology are found to be weak for an industrially and scientifically oriented region such as Europe. A Consortium of academic staff (natural and technical scientists from an existing international network who have been engaged in didactical questions for a considerable time), schools of different types and governmental bodies conducted a project on teaching methods. This project should link demands for science and technologies in industry and economy via schools to universities– including enterprise contacts:

Within the Sixth EU Framework Programme for Research and Technological Development [1], universities of six countries (Czech Republic, Denmark, Finland, Germany, Romania, Spain-BasqueCountry[2]) replaced their science teaching methods in 13 schools, involving more than 700 pupils, 39 classes and more than 30 teachers.

The aim of the study (2006-2008) was to increase the interest of pupils in science subjects and science careers by school science teaching, paying special respect to gender differences between boys and girls: On the basis of an analysis to understand and compare the strengths and weaknesses of school science teaching practices and methods across six different countries in Europe, (with special efforts on analyzing the role of women in this field) a pilot project involving project oriented teaching was launched. The object was to demonstrate a teaching method aimed at motivation of young people, especially women, for sciences.

In addition to observation of the motivational effects, special interest was laid on the analysis of the acquisition of science knowledge with respect to science careers, thus linking school with working life via university. The science teaching method was executed by *P*roject *O*rganized and *P*roblem *B*ased *L*earning (POPBL). This teaching style was transferred from university to school science teaching by means of workshops, in which science teachers learned to adapt POPBL to their teaching situation, and by guidance during implementation. The school subjects concerned were chemistry, physics, biology, technology, computer science, ecology and science. For a while the regular lessons – attached to the curricula – were substituted by POPBL lessons. The school types comprised all types of secondary schools. The pupils´ age ranged from 11 to 19 years. Most of the universities[3] involved were those of applied sciences, with traditionally intensive contacts to industry.

[1] *FP6 - Science and Society 16: Science education and careers.*

[2] *All participating Spanish partners worked within the Basque education ministry.*

[3] *Namely* Czech Technical University *Prague (Country Coordinator: Ass. Prof. Dr. Herman Mann, Computing and Information Centre),* University of Aalborg *(Country Coordinator: Ass. Prof. Birgit Kjaerside Storm, Esbjerg Institute of Technology),* Central Ostrobothnia Polytechnic University of Applied Sciences *(Country Coordinator: Maija Rukajarvi Saaarela, Teaching Faculty of Science),* University of Applied Sciences ~~at~~ Emden/Leer *(Country Coordinator: Inga Scheumann, Technical Department),* Gh. Asachi Technical University *(Country Coordinator: Prof. Dr. Costache Rusu, Faculty of Textile),* Mondragon University of Applied Sciences *(Country Coordinator: Prof. Xabier Arregi and Arantxa Irigoras, Teaching Faculty of Science)*

2 Theoretical Background

*P*roject *O*rganized and *P*roblem *B*ased *L*earning (POPBL) is a “teaching” style which activates pupils to learn instead of listen. The concept of the *problem based learning (PBL)*[1] component is to integrate the „real life“ learning process of human beings into the teaching process. The *project organized* component *(PO)* adds elements of everyday working methods used particularly in the profession of technology[2], thus emphasizing the real life component of PBL.

The basic ideas of POPBL can be deduced from a *phenomenological approach* in science teaching[3], which concentrates on the world observed and experienced by pupils. Starting from FECHNER and MACH (“Psychophysik”, sensationalism) and their scientific successors, a project oriented teaching *integrates the view of the surrounding world - as it is constructed by the pupils in their pre-science experience - with new scientific experiences* introduced by problem based learning at school.

Often scientific language barriers and other scientific obstacles hinder children and students in making any efforts to attain such knowledge. “Scientific culture” is not attractive because it seems so different from what a child feels to have observed and to have competencies in. Successful school science learning however *enables trust in personal competencies* and leads to a (re-)*construction*[4] of pre-science experiences as a key element of *scientific enculturation*. Thus pupils (and students) become able to understand science and will become interested in it.

POPBL was chosen as a method of enabling individual and competence-oriented learning since this teaching form allows teachers and pupils to have individual access to the teaching and learning process, thus taking into consideration that the requirements of pupils of different achievement levels and different levels of interest in science will be met. This eases the access of pupils to science subjects and takes care of potential gender differences.

One constituting element of POPBL teaching (see Figure 1) is the *starting problem that interests pupils* and depends obviously on the country, age group and school type. This problem causes pupils to ask (*inquire*) after appropriate science knowledge and integrates their everyday experience into science lessons.

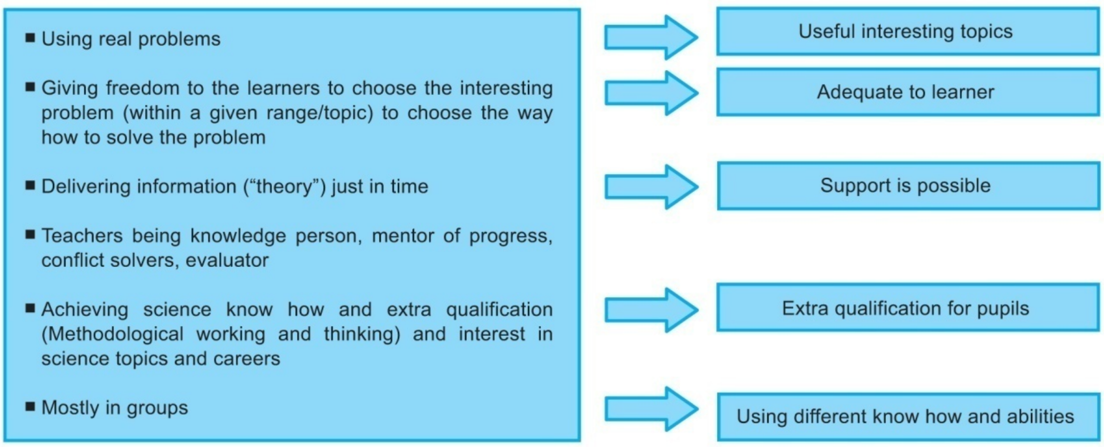

Figure 1: Elements of POPBL[5]

---

[1] *See for the field of medicine: Barrows, H.S. (1996): Problem-Based Learning in Medicine and Beyond, in: Wilkersopn, L.G.; Wim, H: Bringing Problem-Based Learning to Higher Education: Theory and Practice, San Francisco. Barrows, H.S. (1984): A specific, problem-based, self-directed learning method designed to teach medical problem-solving skills, and enhance knowledge retention and recall, in: H.G. Schmidt, H.G.; de Volkers, M.L. (Eds), Tutorials in Problem-Based Learning, Maastricht.*

[2] *Project Orientation is widely discussed for school teaching but mostly without strictly connected to specific know-ledge aims (curricula).*

[3] *See Mach, E.: Über Umbildung und Anpassung im naturwissenschaftlichen Denken. 1883.*

[4] *For principles of constructivism e.g. Bruner, J.: The Culture of Education, Cambridge 1996.*

[5] *Rosenørn, T.: “POPBL, project organized problem based learning”, Aalborg University Esbjerg, Denmark 2003 (1); see also http://www.fh-oow.de/projektarbeiten//downloads/33/rosenoern popbl_sept_2008.pdf, 2009.01.15*

After being presented with the starting problem (for all steps see Figure 2), a class is divided into smaller groups who investigate *certain aspects* within this problem, which is to be solved by individual pupils within the project group.

In the next step within the POPBL process, the pupils *work on their problem by asking and inquiring* from teachers, internet, books, parents, experts and other information sources to reach a solution.

The final results of the different project groups will be *presented* within the group and to all other groups, thus ensuring that everyone in the class receives complete scientific knowledge of the subject (learning aims resp.).

POPBL-Example from School: "How to clean a soiled carpet after a party"

	POPBL course	Learning aims
I.	**Introduction** Situation and brain storming (pupils + teacher)	**Motivation** to get the interest for the subject
II.	**Definition of the project** (pupils + teacher) - learning aims - expected result	**Motivation** for the learning process
III.	**Performance of the project** (pupils, teacher on demand)	**Adoption of the learning process** (to learn how to learn) **Acquiring knowledge** (facts)
IV.	**Presentation of results** (pupils)	**Motivation** for the learning process and the knowledge taken up
V.	**Assessment** (pupils + teacher)	**Assessing the result of the project**

Figure 2: POPBL Phases[1]

The concept of *self-efficacy* explains the increase of interest in science subjects using this teaching method: POPBL learning enables pupils to become scientifically and technically literate, and opens visible results to them: Pupils therefore obtain the necessary self confidence to succeed in science. They experience that they are able to influence ("control") their outcomes in science subjects[2] if they dedicate themselves to science problems encountered in their daily lifes. This concept is discussed in particular for girls and science teaching.[3]

POPBL allows pupils to acquire knowledge not only by listening to teachers and understanding (or not understanding) the content, but also by actively experiencing the content and the suitable learning method themselves, by discussing, exercising, inquiring and thus finding their own individual access to scientific problems. This develops additional social and in particular communication skills, but also extra qualifications such as the ability to organize themselves and to work in groups. This ability is highly relevant to labour market and to successful studies at universities.

POPBL teaching applied within this project was developed by *Aalborg University*[4] for their university students. This method then spread to other universities (including the universities participating in the project) and to some Danish schools.[5] In contrast to "traditional" science teaching in which the teacher begins with

[1] *Rosenørn, T. in Lectures on POPBL in Emden 2007.*

[2] *See concept of self-efficacy by Bandura: "Self efficacy is the belief in one´s abilities to organize and execute the sources of action required to manage prospective situations" (Bandura, A.: Self-efficacy: The exercise of control. New York 1997)*

[3] *See Kosuch, R.: Modifikation des Studienwahlverhaltens nach dem Konzept der Selbstwirksamkeit – Ergebnisse zur Verbreitung und Effektivität der „Sommerhochschule“ in Naturwissenschaft und Technik für Schülerinnen. In: Gransee, C. (Hrsg.). Gender Studies in den Angewandten Wissenschaften, Bd. 3, Hochschulinnovation. Gender-Initiativen in der Technik. Hamburg 2007.*

[4] *Rosenørn, T.: "POPBL, project organized problem based learning", Aalborg University Esbjerg, Denmark 2003 (1).*

[5] *A further field of (only) problem based learning at university can be found in medical faculties (see Barrows, H.S. already cited above).*

theory, POPBL starts with (pupil) experience and proceeds to theory building (see Figure 3), thus activating pupils and ensuring a connection between school science learning and daily life. This process will be continued with each POPBL learning phase and shall result in an increasing learning loop.

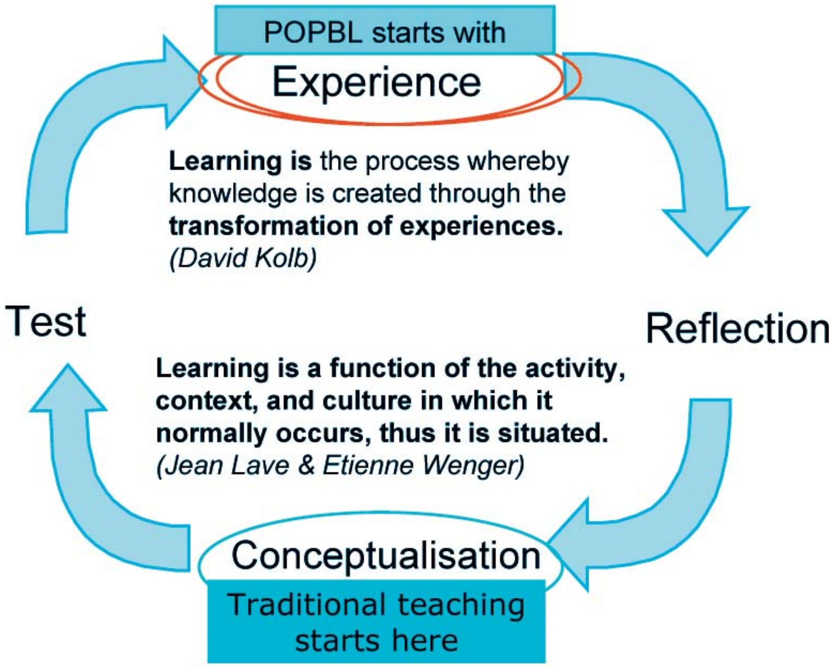

Figure 3: Kolb´s Learning Cycle[1]

POPBL allows not only for pupils to find their individual way to science (*enculturation,* which means the gradual learning of the new rules in the scientific world) but can also be applied in different country cultures. It should therefore be effective in all cultural settings. This was analyzed and proved by applying POPBL in different countries within the project. Cultural differences relating to POPBL-teaching are:

- The distance of POPBL teaching to the actual “traditional” teaching style (Countries whose teaching styles are too foreign to POPBL might not be able nor willing to experience POPBL[2])
- The level of interest and achievement in science subjects being already high in the country (ceiling effect: A country like Finland with obviously excellent achievements in learning science might not profit too much by changing teaching styles to POPBL)
- The particular increase of girls´ interest and participation (ceiling effect: Those countries where girls are already more interested in science subjects might not take too much advantage by changing teaching styles to POPBL.).

All other cultural effects should have no influence on the outcome of the learning process, due to individual access (according to the specific cultures) possible by POPBL.

[1] *Rosenørn, T. in Lectures on POPBL in Emden 2007.*

[2] *Psychology names this phenomenon* “reactance”.

3 Methodological Approach

After an analysis of the situation of science teaching in the schools in the different countries, a pilot study (with an integrated pre-test) was launched (for the phases see Figure 4). This investigated the following topics:

- Can POPBL increase interest in science education and science careers – without lowering the knowledge acquired (in particular an increase of “transfer-knowledge”)?
- Can POPBL be successfully transferred to schools using means of change management by “teaching practitioners” (here: university teachers of science subjects)?
- Is POPBL gender-adequate, thus fostering girls who are still more distanced from science (in some countries)?

The results of POPBL transferred to schools and the emerging further effects were evaluated scientifically by means of *quantitative* data

- Pupils´ questionnaire on science interest (before and after teaching in control class with “traditional teaching” vs. pilot study class with POPBL teaching)
- Class tests (before and after teaching in control class with “traditional teaching” vs. pilot study class with POPBL teaching)
- Exams (= class test in control class with “traditional teaching” vs. pilot study class with POPBL teaching)

and by means of *qualitative data*

- Classroom observations (during POPBL teaching)
- Pupils´ and teachers´ interviews (after POPBL teaching)
- Pupils´ learning diaries and teachers´ learning diaries (during POPBL teaching)

The following hypotheses were persued and tested by both quantitative and qualitative data

H1: The Level of *interest and motivation to learn science* is higher with POPBL.

H2a: Pupils *ability in acquiring science knowledge* (learned facts) is higher with POPBL.

H2b: Pupils *ability in acquiring science know-how* is higher with POPBL (methods and deeper insight in scientific thinking).

H3: The *Transition to labour market and university* is better with POPBL.

H4: There are *no gender differences* in POPBL between pure girls groups and pure boys groups and mixed groups.

Additionally the qualitative information were evaluated and led to further – sometimes unexpected – results, e.g. the phenomenon of unconscious learning[1] or the newly awaked interest in science teaching in particular by long-year-experienced teachers.

[1] *Also named “tacid” learning.*

4 Results and Discussion

The described results are based on pilot studies in *six different countries*, each having different cultures in science, science education and school systems. There are similarities in results – independent of country cultures and of school systems – and differences, which will be discussed and may be explained by cultural factors collected within the project course.

POPBL leads to Increased Motivation of Pupils and Teachers (H1)

POPBL is able to develop the interest of pupils for science subjects. Within the pilot study the measured *interest increased* – especially if qualitative data is regarded.

Teachers´ motivation in science teaching also increased, due to the specific elements of POPBL teaching which allows them continuously changing, "updated" topics within a given curriculum.

The results obtained by qualitative data (observation, interviews, diaries) appear to be consistent, *independent of cultures* prevailing in the six countries and thirteen schools involved, although distances to the former teaching style in some schools was considerable.

An increase of interest towards science careers by POPBL in school science teaching can be expected but not be proved by just one pilot teaching experiment. The decision of the pupils is also influenced by other than school teaching factors alone which has to be kept in mind.[1]

Pupils Learn Science Subjects More Easily (H2) with POPBL

Factual knowledge in science, science know-how and methods (scientific working and thinking that leads to transfer knowledge and to application) and additional skills and capabilities (group work, social effects, communication and self management) are fostered by POPBL, but in different ways:

In most classes the POPBL method led to – surprisingly – good learning results, often to more higher *factual knowledge increase* as in the control group. This effect was even higher for *know-how acquisition*, measured by transfer know-how.

Only one school in Finland expressed the missing of *some detail knowledge* in POPBL teaching whereas the control group displayed this. The teacher concerned in that school joined the pilot study at a later point in time and without pre-test.

Whether girls or boys profit more could not be verified. It seems that there are gender differences and that *girls tend to profit more from POPBL teaching as compared to traditional teaching* – significantly at least when they are younger (Germany) and in general when they were pupils in one of the Spanish (Basque) schools. In some cases, boys seem to take more advantage of POPBL for *transfer questions*. For *boys who usually profit more from traditional teaching,* POPBL shows more advantages in *knowledge acquisition*.

The Transition to Labour Market and University with POPBL Science Teaching Seems to be Eased (H3)

As POPBL works with "real life" projects and project management (adapted to pupils) – it is expected that there should be an inherent connection to labour markets. Additionally, the real life problems the pupils work on will narrow the gap between school and real working life. Therefore, an influence on labour market orientation may be expected for pupils through regular POPBL teaching. Furthermore, the project organizations allows a relatively easy integration of industry partners or other labour market members.In

[1] *Interview data with pupils showed e.g. the competing effect of economic prospects for vocational choices (Czech Republic, Romania)*

the qualitative data – and especially from the countries where company visits were integrated – an increase of interest in science jobs was reported.

Concerning the interest of "working in the field of science", the pupils´ questionnaires did not return distinct answers, or favourable answers towards POPBL teaching. There is, however, no distinct advantage for traditional teaching either. It would, certainly, be presumptuous to assume that one single course in a science subject in school would be sufficient to "change a pupil's mind" concerning the becoming of a scientist, or that it could be observed shortly after the end of one POPBL school course. An application of POPBL over several years, starting with young pupils, will be a better basis for influencing the pupils´ decisions towards science and technology in their future working life. A realistic answer to this question requires a follow up, at least until the point where pupils are exposed to the labour market or where they choose a study course. Interviews, observations and diaries result in a number of indicators for a beginning change of interest towards science careers. The interviews showed, however, that the opinions of pupils in the age bracket of 16 to 18 are already fixed, so POPBL methods must be begun at an early stage if it is to have an influence on long lasting interests.[1]

POPBL Supports Boys´ and Girls´ Science Learning – But Differently (H4)

The "gender question" does not appear to be relevant for all countries participating in the pilot study. The Finnish, Czech and the Romanian partners did not notice meaningful gender differences. German, Danish and Spanish (Basque) schools noted differences within POPBL teaching and its specific methodological approach.

In contrast to the more anxious girls, *boys were observed to start more easily with "dangerous experiments"* and to become motivated and interested by those experiments – for them, "danger" appears to be a challenge and facilitates the access to interesting science "doings".

The boys tended, however, to not work as structurally as the girls but to be more playful (see Spanish (Basque), Danish and German experiences, age group from 11 to 16 years). Girls are described as working in a more planned and result oriented manner (here Romania, Spain-BasqueCountry, Germany) and being able to fully read, understand and follow instructions. Boys evidently seem to suffer under scientific illiteracy, especially when forced to read.

Boys appear to require a *hierarchical order* in their project work, which includes "bosses" and workers. They also have a pecking order which they seem to need and like, whereas girls more often work together as equal team members (observations from Germany). Boys were observed to possess a good pre-knowledge which they share (teachers from Germany). *Girls appear to underestimate their science knowledge* and are evidently less self-confident concerning science.

Regarding these specific gender differences (planning abilities, result orientation, cooperation etc.) girls are expected to especially profit from project oriented teaching (Germany and Spain-BasqueCountry). The data on POPBL teaching outcomes support this fully and especially for mono-educative[2] girls groups. Surprisingly, however, – as shown in comparison to the mono-education group – *boys seem to profit as much as the girls* from POPBL teaching*, but only if they work in projects together with girls*. If working on their own, mono-educative boys (at immediate pre-puberty age) seem to not profit as much as in the mixed POPBL groups.

In the German school, though, where two classes were mono-educatively separated in science lessons, even *the girls who profited most from POPBL explicitly asked to be re-joined co-educationally with the boys* – after the pilot study.

The obtained results lead to the conclusion that girls and boys in three of the participating countries definitely have different abilities and that they need to develop different skills for successful science learning. It appears that both genders would further improve with POPBL project learning, if *boys are capable of*

[1] Interest in science is discussed as being founded quite early in school time, perhaps even at primary school.

[2] Mono-educative teaching describes teaching pupils of one sex only.

learning what girls are able to do (e.g. planning or result orientation) and vice versa (e.g. experiments without fear).

Further Findings

In addition to the formulated hypotheses, the qualitative data led to further results.

- When using POPBL, teachers are required to change and enlarge their *role in science teaching* towards more facilitating and mentoring of the process.
- The introduction of POPBL causes not only a change of teaching style but also results in a *change of the organization:* Lessons had to be combined so that the time for project learning was increased from 45 to 90 minutes or even more. Lesson organization had to be changed, influencing other colleagues – including those not involved in science. Time for extra preparation is required. Additional material has to be provided. Excursions must be prepared.
- *Pupils´ differences* – apart from gender – influence POPBL teaching: *Low achievers* would prefer more guidance, *high achievers* in some countries would prefer traditional teaching, *introverted ("shy") pupils* seem to profit very much from the small POPBL groups.
- The *implementation process* has to be managed: A (successful) change process in the teaching procedure has to emerge, which is not to lead to reactance problems by the teaching staff. Reactance problems can be overcome by involving the teachers in the change process from the beginning. It was i.e. an advantage to have had teachers adapt POPBL to their concrete teaching situation. As Figure 4 shows, the change was set up in three distinct steps. A pretest (Step 2, part 1) was additionally introduced as teachers experienced a need for "training".

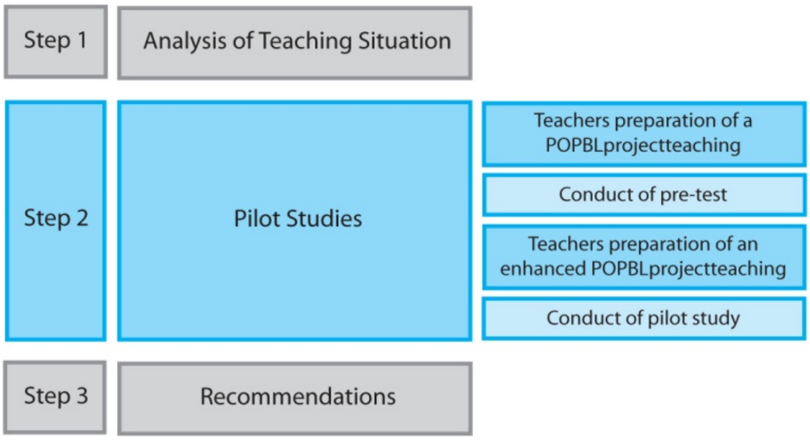

Figure 4: Phases of the POPBL implementation

- *Teachers´ und pupils' overall impression* in the interviews showed the advantages of POPBL but also the required preconditions.[1]
- All *teachers agreed that POPBL as a method will enhance science education.* Nearly all are planning further projects with POPBL methodology and some of their colleagues are already planning such courses. Moreover – this unconsciously, all teachers appear to be integrating PBL elements in their "normal teaching".
- All teachers agreed that not every topic, and everything within one topic, should be taught *by inquiry-based methods* such as POPBL. In their view, pupils are not small geniuses capable of extracting all knowledge by themselves. *They required guidance* in learning – which is already included in university POPBL teaching. This mixture has to be developed appropriately to the specific teaching culture.
- Seen from a *pupils' perspective* (interviews), the *POPBL courses were more fun than "normal" teaching, but sometimes missed the "traditional information".* Figure 5 shows pupils doing POPBL:

[1] *Some details concerning the required preconditions can also be found in Chapter 5: Recommendations.*

- Many of the pupils think that science education is “easier” with normal education, because it is not so demanding for the individual scholar.

Figure 5: Pupils at work: “Carpet Cleaning” (left, right) and “Energy” (middle)

Cultural Differences and POPBL Science Teaching

Science teachings show different traditions in each pilot study country. Data gained in the pilot study ascertain the *cultural component* that is still sizeable in POPBL teaching, which is itself supposed to be culture fair.

In all countries conducting the project, it appears that science teaching is mainly performed by using the traditional frontal teaching. *Teachers from all countries described a change process in their teaching role* from instructor to tutor, who facilitates learning and provided information „just in time“.

A cultural difference appears to be *the role of girls* in science subjects, as previously described.

A further cultural difference is apparent in the attitude of pupils towards cooperation in group learning: While more *cooperative cultures*, such as *Finland*, *Denmark or Spain-BasqueCountry had had good experiences with groups of pupils mixed in achievement level* (i.e. the stronger pupils helping the weaker ones within the groups), more *competitive school cultures*, such as to be found for example in *Germany, had problems with the integration of weaker pupils and the satisfying of the stronger*. In particular, fast-learning pupils regarded the methodology as too slow for their tastes – certainly considering their conscious learning processes more, and disregarding unconscious learning as well as peer teaching learning processes.

In some countries on the contrary, such as *Finland and Denmark*, the *high achievers clearly knew that they also benefit from the teaching of other pupils*, they learned themselves while explaining. It was no problem with mixed pupil groups of above and below average achievement. It may be certainly useful to explore this field more intensively.

5 Recommendations

The future challenges of industrial countries demand more scientists and engineers being capable of approaching new technologies, and to link the different spheres of human activities for a sustainable future. The demographic development in many European countries, and the increasing demand for scientists and engineers, open new human potentials by interesting more young people for sciences and technologies. This must begin at schools within science teaching and is to continue at universities.

POPBL is an efficient tool, to be used as a stimulation for science teaching and learning in all cultural settings involved in this project. POPBL is clearly capable of increasing motivation for learning and knowledge acquisition, including *the group of originally "average" pupils.* This distinguishes POPBL from other science teaching initiatives being more concerned about the "better" pupils ("elite").

The results of this project lead to the recommendation to include POPBL for science teaching methods to the normal repertoire of all science teachers. This can be recommended in all countries and schools, although improvements may not be equally high for all countries.

The following collateral recommendations for the introduction of POPBL are given:

1. For science teaching, POPBL should be included within the regular curriculum. Teaching scientific subjects using POPBL takes more time (initially) but will offer additional advantages. Pupils are able to apply these learning methods in other cases, they achieve a knowledge transfer.
2. POPBL should be started with young pupils and simple, short projects. This leads to a smooth development of learning method and motivation.
3. Projects should be connected to the everyday life of pupils, whereas in higher school forms a link to industry/companies would enhance motivation.
4. POPBL teaching should become a further tool in teachers' methodical repertoires, being taught and probed in teacher education as one module in school science teaching.
5. Some teacher personalities can master insecurities (which will appear with POPBL) better than others. If a teacher is not able to cope with incalculable situations, he/she may not choose this activating and motivating way of teaching. Support by experienced colleagues will help to overcome these difficulties. It will also be helpful (for pupils and teachers) to start with a "pretest", a small project where the application of the teaching method can be developed.

6 Dissemination

As described above, pupils and teachers learn POPBL by doing it. Therefore the *side-to-side-way dissemination* is highly efficient; experienced teachers represent experts and role models for their colleagues (see Figure 6).

For project team understanding, it will be optimal to have side-by-side-introduction parallel to a top down-distribution integrating e.g. school authorities (see Figure 7).

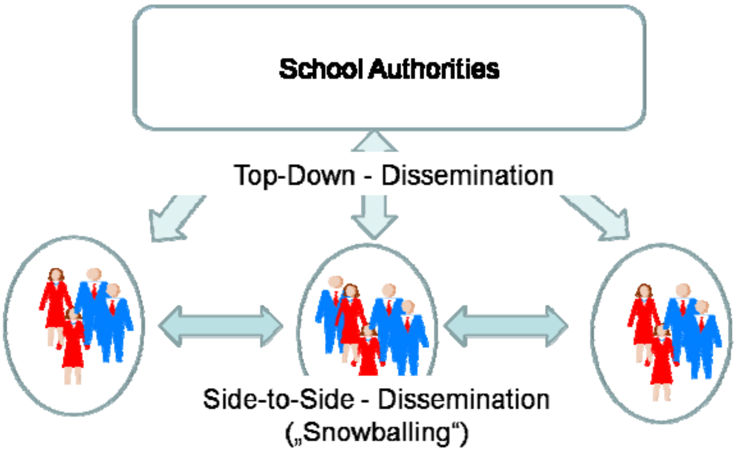

Figure 6: Dissemination of POPBL – complementing ways

Within all participating countries, a snowballing effect has already started and dissemination still continues in the form of snowballing: On the one hand, POPBL experienced teachers work as change agents – more or less automatically. On the other hand, publications evoke interest in new science teachers as well as in educators for science teachers (science didactics). Although mostly POPBL starters question the method in the beginning, once they have used it they are fascinated with its effects. An intensive discussion has therefore started nationally and internationally. Teacher workshops (national or international) are of great assistance for the exchange of experiences and improvements of the method.[1]

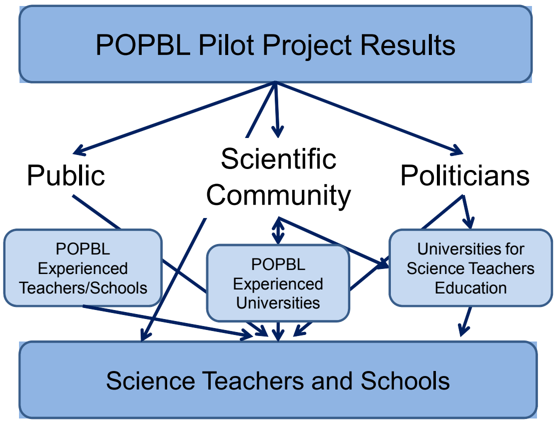

Figure 7: Different cooperating ways of dissemination

In some countries the integration of schools authorities has also occurred.

The international dissemination started with the final international symposium. According to project aims, the European-wide dissemination includes different target groups which should be reached:

[1] *First workshops took place in Latvia, Netherlands and Germany in 2009.*

- Schools and teachers
- Politicians
- Public
- Scientific world for research on teaching methods

These groups were reached directly by specific actions such as target oriented workshops and by general tools such as web pages, conferences etc. Those methods of dissemination support each other (see Figure 7).

Direct Dissemination to Schools and Teachers

Concerning the dissemination in schools and to science teachers, there were actions already taken during the project, which were to include these teaching and learning methods in the regular repertoire of teaching styles within the schools participating. The experiences of the participating teachers were imparted in a kind of snowball effect to other teachers. In all participating countries the teachers involved in the project not only continued with POPBL themselves in further regular science lessons, but also dispersed the new methods within their schools, integrating their science colleagues.

Furthermore, teachers and school principals from other schools participated in the Final Symposium in September 2008, thus informing themselves about POPBL and its possibilities for their daily teaching. General information on POPBL for teachers still takes place, covered by international and national homepages.[1]

In several of the participating countries[2] the teachers and schools engaged in the project disperse the POPBL *in teachers' education* via

- Special courses for experienced teachers (Germany, Spain)
- Special workshops (Denmark)
- Teacher education (Spain by means of Mondragon University or Finland by means of Kokkola University).

Workshops in other non-participating countries were also initiated as a result of international publications, conferences and symposia. One of these courses took place in Latvia, in cooperation with Riga Technical University (25.-27.02.2009).

Additionally, a *collection of successful POPBL science teaching examples* from the different countries and science subjects was developed in cooperation with all project teachers, and is now in preparation for publishing (for an example see Annex).

Dissemination to Politicians

A further way for dissemination – already used – is the way of introducing the method to school authorities, thus implementing it in the standard method of regulated *change top-down*. The latter dissemination ought to accompany side-by-side-disseminations, because POPBL teaching methods require on the one hand learning by doing (as does POPBL learning with science topics) and on the other hand the support of organizations being responsible for school organization, curricula etc. (see Figure 6).

Ensuring a *push effect of dissemination* from project start onward, politicians responsible for science teachers' education were integrated into the project. This ensured that the outcomes spread quickly. In particularly, in Romania the school responsible was an active member of the advisory board; the same was organized in Germany thus ensuring a broader dissemination across non-participating schools.

[1] *See Chapter 2.3.*

[2] *See under Chapter 1, Table 2.*

The Final Symposium in September 2008, with final project results being presented and recommendations given, was patronized by the former Minister of Science of Lower Saxony, Lutz Stratmann, who was personally present and opened the conference. His colleague Vera Reinecke represented the Ministry of Education, as she is responsible for all science teaching in this German federal state. The Finnish education policy was represented by Maja Montonen from the Finnish Board of Education.

Dissemination to the Public

Different publications were launched to reach a wide public and thus implement a pull effect to changes in natural science teaching for parents and others.

Each workshop during the project was accompanied by local and national press releases and almost always by short homepage notifications.

In addition, parents were informed about the project in all early schools, becoming involved by their children's "stories" about their project work, or by listening to the project presentations. It was therefore ensured that parents became interested in these teaching methods and supported them. In some countries (e.g. Germany), furthermore, parents received information about the project results and project recommendations for politics and teaching staff in special parent "lectures".[1]

Homepages and a forum not only helped communications within the project but supported, and still support, this communication to all target groups. Reactions from different users show that these homepages support dissemination greatly.

A central project homepage is installed at the coordinators site both in English and in German.[2] During the project duration a special forum for project wide information and discussion was set up. The access via password was opened to all interested inquirers.

All country coordinators set up POPBL homepages in their country language and in part English, or integrated the project in their existing homepages. Most of the schools also integrated POPBL into their existing homepage.[3]

Dissemination to the Scientific Community

Conferences are highly important for the dissemination of the ideas of POPBL teaching and project outcomes, as they lead to personal discussion and conviction. It was therefore decided to participate in international conferences within the final project work. This is to be still continued after the end of the project with all results available.

1. Education Conference in Helsinki (Hayo Siemsen: *Mach, Kaila and Kurki-Suonio – a comparison*, Conference, Helsinki, 13.06.*2008)*

---

[1] *See Annex 2 and Annex3: The latter shows an example on dissemination to the public and especially to the parents by means of an article in a local newspaper describing a project on boat construction and including a very appealing photo of the boat launch on the canal nearby the school.*

[2] *http://www.fh-oow.de/projektarbeiten /index.php?id=615*

[3] *In 2010 these were http://virtual.cvut.cz/popbl/objectives.html; http://icosym.cvut.cz/mann/projects.html (Czech Technical University); http://www.gyarab.cz/?page=popbl (Arabska Gymnasium, Prague); http://www.aaue.dk/~av/e/popblitaly.pdf (Aalborg University with general information on POPBL); http://www.hs-emden-leer.de/forschung/popbl/; (University of Applied Sciences Emden/Leer - former: Oldenburg/Ostfriesland/Wilhelmshaven); http://nibis.ni.schule.de/~kgsgfehn/archiv/zeitungs_archiv/26.09.2008on.eu-projekt.htm (KGS Großefehn); http://www.ernstabbegymnasium.de/ (projekte) (EAG Eisenach); http://www.igs-aurich-west.de/seif7.htm (IGS Aurich); http://www.cou.fi/ajankohtaista/index.asp?aid=87 (Central Ostrobothnia University, Kokkola); http://www.tuiasi.ro/; http://www.cetex.ro/proiecte/internationale/ (Technical University "Gheorghe Asachi", Iasi); http://gsis.airbites.ro/index_files/Page415.htm (Ioan Stefanescu School, Iasi); http://www.grup2sv.ro/index.php?id=proiectcontinuare1.htm (Colegiul Tehnic "Petru Musat" Suceava); http://www.mondragon.edu/eps/noticias/semana-popbl0?set_language=es (Mondragon University (including the participating schools)*

2. Ernst Mach Conference in Prague (Hayo Siemsen: *The psychology of Ernst Mach*. Ernst Mach Conference, Prague, 15.05.2008)

3. FORUM SCIENTIARUM; Tübingen University (Hayo Siemsen: *Ernst Machs Erkenntnistheorie: Begriffsbildung als Anpassungsprozess*, Tübingen 20.06.2008)

4. 5th International Seminar on the Quality Management in Higher Education 2008 – conference papers see above.

5. SEFI Annual Conference in Rotterdam 2009 – conference paper see above.

Further publications are in preparation discussing the emerging results on the new data which was achieved in the German partner school in 2009 (by a university driven study after the project end). The project partners, especially the schools, are interested in continuing to establish a broader basis for POPBL, and are thus looking for or using further *appropriate EU call*.

7 Outlook

POPBL science teaching is a very effective way of evoking interest in science subjects, and for the building of self efficacy in learning science for pupils that are not otherwise close to science subjects (see Figure 8). The method can only be learned by teachers and pupils in an active manner. Phenomenon oriented and inquiry based learning is the fundament of POPBL teaching, which is to be learned by teachers *and* by pupils.

- **Acquiring factual knowledge, general principles and examples (and competences/methods)**
  ⇨ memory stimulated by active learning in groups, by connecting to existing knowledge
- **Acquiring methods for learning science (using books, internet, asking teachers …)**
  ⇨ deep understanding and capability to encounter new scientific topics by themselves
- **Narrowing the gap between science and every day life experience**
  ⇨ meaningful knowledge ⇨ more motivation and effort
  ⇨ more associativity/analogy
- **Learning in a self-directed way and explaining to co-pupils**
  ⇨ transferable knowledge ⇨ more success in further problem solving
  ⇨ deeper understanding ⇨ more self-confidence
- **Continuous motivation for teachers**
  ⇨ always new topics possible

Figure 8: Consequences of POPBL for Science Teaching

POPBL is acquainted with similar methods but shows extra qualification in teamwork, in communication, presentation and in self-organization. That makes it very attractive regarding links to labour market transitions. School projects may additionally be involved and can be easily connected with enterprises and universities, thus attracting pupils to science careers.

POPBL encounters gender differences, offering a basis for adequate learning suitable to girls and boys: Here girls – especially in Middle Europe – have the meaning that science is connected to their daily life as the teacher is "forced" to find a gender-adequate problem by this method. Girls can pick up a problem aspect that thereby suits their interests – which most science textbooks do not do up until now. In the course of learning, they will experience success and therefore increase their self-efficacy for science. Both aspects together will lead to an enlarged interest in science subjects and science careers.

It is proposed to install and secure a mixture of POPBL and frontal teaching, starting early in education. POPBL requires some time and also appears to be more demanding for pupils as well as for teachers. The variety of different teaching methods will give each method and each individual profile of pupils and of teachers a chance for optimization.

Annex 1: POPBL School Example (Spain)

Unterrichtsbeispiel Physik **[SCHOOL SCIENCE TEACHING BY PROJECT ORIENTATION - POPBL]**

„WIE MAN NACH EINER PARTY SCHNELL DEN TEPPICH REINIGEN KANN“

POPBL-Projekt: Physik, 10. Klasse, Baskenland

Schulkontext

- POPBL wurde alle Kollegen vorgestellt – im Rahmen eines ein- bzw. zweitägigen Workshops.
- Kollegen liehen ihre Stunden für das Projekt.
- Der Stundenplan wurde entsprechend darauf ausgerichtet, da hier das POPBL-Lernen rechtzeitig bekannt war.

Klasse und Schüler

- 17 Schüler (12 Jungen, 5 Mädchen), 1 Lehrer
- 10. Klasse (4. Klasse der weiterführenden Schule), 16jährige Schüler

Fach und Thema des Curriculums

Physik und Chemie: Chemische Reaktionen, insbesondere Reaktionszeiten

Ausgangslage in der Klasse

Die Klasse hatte sich schon vorher mit chemischen Reaktionen beschäftigt. Die Schüler wussten, was chemische Reaktionen sind, und waren in der Lage, sie zu steuern und zu berechnen, in welchen Mengen und in welchem Verhältnis die Substanzen an der Reaktion teilnahmen

Der Lehrer wählte nun einen „qualitativen Ansatz“, um die Variablen zu identifizieren, die Einfluss auf die Reaktionsgeschwindigkeit haben, und wie dieser Einfluss aussieht.

Stundenumfang und Organisation

Der Gesamtumfang für die Schüler betrug 17 Stunden

- 10 Stunden in der Schule, um das Problem zu lösen
- 5 Stunden Hausaufgabe, um den Bericht zu schreiben und die Präsentation vorzubereiten
- 2 Stunden, um das Projekt vor den Klassenkameraden zu präsentieren (9 Tage später)

Die Schulstunden wurden in einer Woche durchgeführt. Um dies zu ermöglichen, wurden zu den drei Wochenstunden des durchführenden Lehrers noch 7 Stunden von Kollegen geliehen, so dass er jeden Tag zwei Stunden hintereinander zur Verfügung hatte.[1]

Ressourcen

Der Unterricht wurde im Wesentlichen im Labor durchgeführt. Zusätzlich wurde auch der Computerraum genutzt, um Informationen zu erhalten. Außerdem beschafften sich die Schüler Informationen von ihren Familien.

Die Schüler brachten das Experimentalmaterial von zu Hause mit, mit Ausnahme von Teppichboden-Stücken, die der Lehrer kaufte.

Kontakt:
Prof. Maria Krüger-Basener
Hochschule Emden/Leer - Fachbereich Technik
Constantiaplatz 4 - 26723 Emden
Tel.: +49 (0) 4921 807-1819 - Fax. +49 (0) 4921 807-1843
krueger-basener@technik-emden.de - http://www.technik-emden.de/~mkb/
http://www.hs-emden-leer.de/forschung/pobl/

[1] In anderen Schulen wurden nur 2-4 Stunden pro Woche auf das Projekt verwandt. Entsprechend verlängerte sich die Durchführungszeit.

Annex 2 – Example for disseminating POPBL from university to school and to the public (Finland)

LÄNSIPUISTON SANOMAT 17

Luonnontieteitä uusin metodein

Tuula Heikkilä
biologian ja maantieteen lehtori

Solubiologian kurssilaiset esittelevät itse omasta DNA:staan valmistamiaan kaulakoruja. Kuva: Tuula Heikkilä

Joulukuussa 2006 käynnistyi koulussamme kaksivuotinen EU:n luonnontiedeprojekti POPBL. Tämä kansainvälinen hanke pyrkii kehittämään koulujen luonnontieteiden opetusta projektipainotteisen, ongelmakeskeisen oppimismenetelmän eli POPBL:n avulla. (Project Organized, Problem Based Learning).

Mukana Suomesta oli kaksi keskipohjalaista lukiota; Kokkolan yhteislyseon lukio(biologian lehtori **Tuula Heikkilä** ja kemian lehtori **Teemu Känsäkangas**) ja Kalajoen lukio (kemian lehtori **Päivi Ojala**) sekä Suomen toiminnan koordinattorina Keski-Pohjanmaan ammattikorkeakoulu (lehtori **Maija Rukajärvi-Saarela**).

Muita osallistuvia maita ovat Saksa, Romania, Tsekin tasavalta, Espanja ja Tanska. Yhteensä kokeiluun osallistui 13 koulua, liki viisisataa opiskelijaa (meidän koulusta 80 opiskelijaa) ja n. 30 opettajaa kuudesta maasta. Opiskelijat olivat iältään 12-19-vuotiaita.

Tavoitteena lisätä opiskelumotivaatiota

Projektin tavoitteena oli edistää opiskelijoiden mielenkiintoa ja motivaatiota luonnontieteisiin, lisätä opiskelijoiden kykyä hakea luonnontieteellistä tietoa, taata nuorten joustavampi siirtyminen työelämään tai yliopistoon jatko-opintoihin, huomioida sukupuolierot ja osoittaa menetelmän mahdollisuudet parantaa koulun tiedeopetusta. Taustalla on huoli luonnontieteellisillä ja tekniikan aloilla Euroopassa yleisesti tapahtuneesta hiipuvasta kiinnostuksesta näiden alojen yliopisto-opintoihin.

Projektin kuluessa osallistuvien maiden opettajat ovat kokoontuneet eri osallistujamaissa vertailemaan maiden koulujärjestelmiä, pohtimaan projektin etenemistä ja ilmenneitä ongelmakohtia. Esimerkiksi toukokuussa 2008 kokoonnuttiin Romanian Iasiin, jossa eri maiden opettajat esittelivät tekemiänsä pilottihankkeita.

Syyskuussa 2008 pidettiin projektin päätöstilaisuus Saksan Emdenissä, jossa paikalla oli myös eri maiden opetusalan asiantuntijoita ja päättäjiä. Suomesta päätösseminaariin osallistuivat opettajien lisäksi mukana olevien lukioiden rehtorit ja opetusneuvos **Marja Montonen**.

POPBL-menetelmän avainsanat ovat projektipainotteisuus ja ongelmakeskeisyys sekä tutkivan oppimisen periaate. Vastuuta oppimisesta annetaan enemmän opiskelijoiden harteille, joten opettajan tehtävänä on antaa opiskelijoille ratkaistavaksi mielenkiintoinen ja tarpeeksi haastava ongelma, joka liittyy kurssin keskeisiin sisältöihin. Opiskelijoille kerrotaan myös tarkasti projektin tavoitteista, jotta he osaisivat keskittyä olennaisiin asioihin. Mielekästä on pohtia ongelmaa ryhmissä, jotta syntyy keskustelua ja saadaan enemmän näkökulmia ongelman ratkaisuun.

Emdenin päätösseminaariin osallistuneet suomalaiset yhteispotretissa. Vasemmalta Päivi Ojala, Maija Rukajärvi-Saarela, Marja Montonen, Tuula Heikkilä ja Riku Saksholm.

Vetoketju ja ruisleipä tutkimuskohteina

Meidän koulussa projektitehtävänä kemiassa oli selvittää vetoketjun elinkaari. Solubiologian kursseilla puolestaan pohdittiin syödyn ruisleivän, oman DNA:n ja solujen välistä yhteyttä. Tehtävänannon jälkeen opettajan tehtävänä on lähinnä seurata ryhmien työskentelyä ja antaa neuvoja kysyttäessä. Sovittuna ajankohtana projektityö täytyy olla valmis, ja se esitellään muille ryhmille esim. Powerpointin, posterin tai vaikkapa draaman muodossa.

Suomalaiset pilottitutkimukset osoittivat, että opettajan rooli on POPBL-menetelmässäkin tärkeä ja opettajaa kaivataan antamaan oikea-aikaisesti teoriaopetusta. Toisaalta opettajan rooli muuttui enemmän tiedonjakajasta opetuksen suunnittelijaksi, ohjaajaksi ja tutoriksi.

Tärkeäksi tehtäväksi nousi oppimiseen motivointi. Menetelmän avulla onnistuttiin lisäämään oppilaiden mielenkiintoa ja motivaatiota luonnontieteisiin. Myös opettajien työmotivaatio lisääntyi menetelmän myötä. Opiskelijoiden haastatteluissa nousi myös keskeiseksi motivointiin vaikuttavaksi tekijäksi opettajan innostuneisuus.

Pilottiryhmissä opiskelleet nuoret saavuttivat myös hieman paremmat faktatiedot kuin kontrolliryhmät. Tämä ei pätenyt kuitenkaan kaikkiin maihin eikä kaikkiin tutkimusryhmiin. Esimerkiksi omissa pilottiryhmissäni käsitteiden hallinta oli hieman heikompaa kuin kontrolliryhmässä.

Mielenkiintoinen havainto oli, että menetelmässä tapahtuu paljon ns. tiedostamatonta oppimista, jota on kuitenkin vaikea mitata. Tämä taas johtaa oppimistulosten aliarvioimiseen

Vaikutukset opiskelijoiden uravalintoihin ovat vaikeasti ennustettavissa. Kuitenkin luonnontieteelliset ammatit näyttivät nostavan suosiotaan vähän etenkin poikien keskuudessa. Yhteydet yrityksiin ja korkeakouluihin koettiin kaikissa maissa antoisina ja motivaatiota lisäävinä.

Tuloksissa maakohtaisia eroja

Tulosten perusteella Suomessa sukupuoli ei ollut merkittävä tekijä opiskelijan motivaatiota ja oppimista tutkittaessa. Tässä oli kuitenkin suuria eroja tutkimusmaiden välillä. Yleisesti ottaen pojat näyttivät hyötyvän menetelmästä tyttöjä enemmän.

Maakohtaiset tulokset osoittivat, että POPBL-menetelmästä hyötyivät eniten Saksa, Espanja, Tsekin tasavalta ja Romania ja vähiten Suomi ja Tanska. Suomessa ja Tanskassa tutkivalla oppimisella on pitkät perinteet ja opetusmenetelmien kirjo on muutenkin suurempaa, joten POPBL:n vaikutukset eivät ole niin huomattavia.

POPBL:sta potkua opettajan työhön ja opiskelijoiden jatko-opintoihin

POPBL-menetelmä on yksi hyvä mahdollisuus opettaa luonnontieteitä lukiossa ja tuo mukavaa vaihtelua perinteiseen opetukseen. Opettajan näkökulmasta kokemukset projektista olivat rohkaisevia ja kannustavat hyödyntämään menetelmää opetuksessa jatkossakin.

Kokeilu sai myös minut pohtimaan oppimisprosessia ihan uudella tavalla. On todellakin merkittävämpää miten asioita opetan kuin se mitä ehdin opettaa.

POPBL:in toteuttaminen edellyttää kohtuullisia ryhmäkokoja ja myös opiskelijoilta uudenlaista asennoitumista opiskeluun. Tärkeää on, että jo alakoulusta lähtien oppilaat olisivat tottuneet työskentelemään projektipainotteisesti, koska monissa yliopistoissa ja ammatillisissa oppilaitoksissa projektityömenetelmät ovat yleisessä käytössä. Myös työelämässä tarvitaan nykyään yleisesti POPBL-menetelmän opettamia tiimityötaitoja.

Projektille on mahdollisesti luvassa jatkoa v. 2009, jos uusi rahoitushakemus saa EU:n hyväksynnän. Tällöin olisi tarkoitus laajentaa kokeilua käsittämään kaikki luokka-asteet ja mahdollisesti jopa tarhaikäiset.

Annex 3 – Example for disseminating POPBL to the Public via local newspaper (Germany)

"Pupils as clever canoe constructors"

Siedlerhuus Hinrichsfehn.

Skat statt Dart

MARCARDSMOOR - Am heutigen Sonnabend findet um 14 Uhr im Dartclub in Marcardsmoor ein öffentlicher Preisskat statt. Zu gewinnen gibt es Fleischpreise.

Vortragsabend

WIESMOOR - Die Kolpingfamilie Wiesmoor lädt für Mittwoch, 20. Februar, um 20 Uhr zu einem Vortrag ins Pfarrheim ein. Referent Ulrich Kötting aus Aurich spricht über Kardinal von Galen, den „Löwen von Münster". Gäste sind herzlich eingeladen.

Altpapiersammlung

BAGBAND - Bis einschließlich Sonntag, 17. Februar, sammelt die Kirchengemeinde Bagband wieder Altpapier im Container auf dem Parkplatz bei der alten Schule. Mit dem Erlös aus dem Papierverkauf soll die Gemeindekasse aufgebessert werden. Bei der letzten Sammlung kamen zweieinhalb Tonnen Altpapier zusammen.

Faschingsparty

SPETZERFEHN - Heute ist Faschingsparty der Oberstufe der KGS Wiesmoor im Spetzer Fehnhuus in Spetzerfehn. Beginn ist um 20 Uhr.

IM NOTFALL

WIESMOOR/GROßEFEHN: Jade-Apotheke, Schützenweg 2, in Friedeburg, Tel. 0 44 65 /94 51 44.

DER DIREKTE DRAHT

Die Redaktion Wiesmoor der Ostfriesen-Zeitung erreichen Sie unter Telefon 04944-9195-12 -13

Schüler als clevere Kanu-Konstrukteure

BILDUNG Bootsbau-Projekt an der KGS Großefehn soll bei Jugendlichen Interesse an Technik wecken

Emder Studenten werden untersuchen, ob das Ziel erreicht wurde. Die Boote wurden gestern ausprobiert.

VON TATJANA GETTKOWSKI

GROßEFEHN - Testfahrt auf dem Timmeler Meer: Rita Cirpka streift sich ihre Schwimmweste über, nimmt Platz auf der mit rotem Samt bezogenen Sitzbank des kunterbunten Kanus und paddelt los. Vier Schülerinnen der Kooperativen Gesamtschule (KGS) Großefehn jubeln ihrer wagemutigen Physiklehrerin vom Ufer aus zu. Bei der Probefahrt zeigte sich gestern: Das eckige Holzboot, das sie in den vergangenen Monaten selbst konstruiert und gebaut haben, schwimmt tatsächlich.

Graue Theorie und dröge Formeln verbinden viele Schüler mit dem Physikunterricht. Das „Profil Naturwissenschaften" – das ist ein verpflichtender Nachmittagsunterricht an der KGS – verfolgt dagegen den Ansatz, Wissen durch Praxis zu vermitteln, damit die Lerninhalte bei den Schülern hängen bleiben.

Aufgabe der 15 KGS-Schüler war es, ein Boot zu konstruieren und zu bauen, das ein Gewicht von 150 Kilogramm trägt und schwimmt. Material, Farbe, Form – die Schüler konnten völlig frei schalten und walten. Nach den Herbstferien des vergangenen Jahres legten die Schüler in vier Gruppen los.

„Wir haben uns Informationen im Internet besorgt

Bootsbauerin Tina Meyer, die gemeinsam mit Sarah, Lisa Bohlen und Lina-Maria Komminga in einem Team gearbeitet hat.

Die vier Mädchen verloren bei der Arbeit schnell die Scheu vorm Umgang mit Säge, Akkuschrauber und

gedacht hatten – und die ist sogar noch bezogen", lobt Physiklehrerin die cleveren Kanu-Konstrukteure. Die Schülerinnen der Klasse 9 gl seien voller Elan bei der Sache gewesen. „Ich traue der einen oder anderen durchaus zu, einen technischen Beruf zu er-

der insgesamt vier Boote sogar zu den Kanus mit den besten Schwimmeigenschaften.

Ob dieser praxisbezogene Unterricht bei den Schülern tatsächlich die Motivation geweckt hat, sich mehr als zuvor für Technik und Naturwissenschaft zu begeistern, wollen

dem Projektbeginn wurden die Kenntnisse der Schüler in Sachen Bootsbau abgefragt. Danach wurden sie erneut zum Thema befragt. Gleichzeitig wollten die Studenten wissen, wie es vor und nach dem Projekt um das technische Interesse und die techni-

Das Projekt

Die Fachhochschule Emden beteiligt sich am EU-Projekt „Problemorientiertes Projektbasierendes Lernen". Auch Hochschulen in Rumänien Dänemark, Finnland, Spanien, Tschechien sind beteiligt.

Hintergrund ist das europaweite Phänomen, dass es um das Interesse von jungen Leuten an naturwissenschaftlichen und technischen Fächern schlecht bestellt ist.

Um dem drohenden Mangel an Ingenieuren und anderen Fachkräften entgegenzuwirken, soll nun an Schulen das Interesse an Technik durch besondere Projekte geweckt werden. Emder Studenten werden jetzt untersuchen, ob der praxis- und projektbezogene Unterricht im „Profil Naturwissenschaften" an der KGS Großefehn Früchte getragen und das Interesse an Technik bei den Schülern verstärkt hat.

Probefahrt mit Schwimmweste: Physiklehrerin Rita Cirpka von der KGS Großefehn testete auf dem Timmeler Meer, ob die Boote ihrer Schüler schwimmen. BILD: GETTKOWSKI