

# Teaching Based on Projects

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**Key words:** Education, Master of Science, project, group work, surveying.

## SUMMARY

The Olympic Games has its roots in the ancient Greece. The development of surveying technology and production of early maps took place during the same period. The Olympic Games have always brought people together in peace to respect universal moral principles. The basic ideas with the Olympic Games can be compared with the ideas of International Federation of Surveyors. People from all over the world, with different backgrounds, meet and exchange experiences.

The education in “Master of Science in Engineering – Land Surveying and Management” in Lund, Sweden, promotes learning in national systems as well as in foreign systems. During the education both international and national history are of importance. One of the aims with this Swedish education is to educate students in an international atmosphere and prepare them for work also in developing countries.

The method of teaching at the “Master of Science in Engineering – Land Surveying and Management”-education in Lund is different from other educations in Master of Engineering. Each term is based on a theme and a project that brings together the various subjects. During one of the terms the subjects geology, environment, law and traffic engineering are studied. The knowledge in these subjects results in a theoretic project in construction of a Swedish highway. Another example is the term when land information systems, GIS, surveying and geographical databases are studied. The projects purpose is to build a cadastral system with allotment gardens, containing all information of importance and besides that a general map. Other examples of projects are valuation of detached houses, use of GIS in different solutions and exploitation of domains.

This special education system is based on reality and therefore helps students to develop preparation for their future professional role. The projects are organized in groups, with three or four students, which give the students plenty of experience in team working. Compared to usual teaching this way of studying increase the knowledge because of the continuous learning. The majority of the projects are performed in cooperation with Swedish companies and this makes the students more prepared for the job market.

The opportunity for students to visit the FIG Working Week together with professional surveyors from all over the world helps young and old, experienced and non-experienced, people from more or less developed countries to keep the “Olympic Spirit” in Surveying.

**Sökord:** Utbildning, civilingenjör, projekt, grupparbete, lantmäteri.

## **SAMMANFATTNING**

De olympiska spelen har sina rötter i det antika Grekland. Under samma tid pågick utvecklingen av mätningstekniken och produktionen av tidiga kartor. De olympiska spelen har alltid verkat för fred mellan människor och för att respektera våra moraliska principer. Den grundläggande idén med spelen kan jämföras med idén för FIG, International Federation of Surveyors. Idén innebär att människor från hela världen, med olika bakgrund, träffas och utbyter erfarenheter.

Civilingenjörsutbildningen inom Lantmäteri i Lund, Sverige, främjar inläring av nationella såväl som utländska system. Under utbildningen är både nationell och internationell historia inom ämnet viktig. Ett av syftena med den svenska utbildningen är att utbilda studenter i en internationell atmosfär och därmed förbereda dem för arbete inte bara i Sverige utan även utomlands, i till exempel utvecklingsländer.

Metoden för undervisningen på civilingenjörsutbildningen i Lantmäteri i Lund är annorlunda jämfört med andra civilingenjörsutbildningar. Varje termin är baserad på ett tema och ett projekt. Projektet gör att olika ämnen vävs samman till ett redan från början. Under en av terminerna studeras ämnena geologi, miljökunskap, juridik och vägprojektering. Kunskaperna från dessa ämnen resulterar i ett teoretiskt projekt som går ut på att konstruera en större svensk trafikled. Ett annat exempel på en termin är där geografiska informationssystem, mätning och geografiska databaser studeras. Meningen med projektet, som görs i anslutning till dessa ämnen, är att ett fastighetsregister för kolonilotter skall skapas. Registret skall innehålla all viktig information angående kolonilotterna och dessutom skall en karta över området göras. Övriga exempel på projekt är värdering av villor, användning av GIS vid olika problemställningar och exploatering av kommersiella fastigheter.

Det här speciella utbildningssystemet är baserat på verkligheten och hjälper därför studenterna att utveckla förberedelserna inför den framtida yrkesrollen. Projekten är organiserade för grupparbete, med tre till fyra studenter i varje grupp. Detta ger studenten stora erfarenheter när det gäller att arbeta i grupp. Jämfört med vanlig undervisning ökar det här systemet studentens kunskaper på grund av den kontinuerliga inläringen. Majoriteten av projekten utförs i samarbete med svenska företag och det gör att studenterna förbereds mer för arbetsmarknaden.

Möjligheten för studenter att besöka ”FIG Working Week” tillsammans med professionella lantmätare från hela världen hjälper unga och gamla, kunniga och mindre kunniga samt människor från mer eller mindre utvecklade länder att hålla den olympiska andan uppe inom lantmäteriområdet.

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## 1. INTRODUCTION

Students in the “Master of Science in Engineering – Land Surveying and Management” - education in Lund, Sweden, are compared to students in other educations in Sweden studying in a special way. The education does not take place in ordinary courses but in extensive terms based on themes. The reason is that the students will get a better connection between the subjects and at the same time increase the comprehension. The studying at the University will by this way more and more resemble the work in the future working life.

We are Swedish students at the “Land Surveying and Management” - education in Lund. The education is a “Master of Science in Engineering”-education and therefore demands four and a half years of studying. We are now studying our third year at the program and that means that we have read all the compulsory terms based on themes.

## 2. LUND INSTITUTE OF TECHNOLOGY

Lund is a city, with about 100 000 inhabitants, situated in the southern part of Sweden. Almost a quarter of the inhabitants are studying at Lund University.

Lund University



Source: Homepage Lund Institute of Technology 1 (2004)

Lund Institute of Technology (LTH), Lund University, is one of the largest higher educational institutes in Sweden for technical and engineering sciences, with over 6000 students. LTH belongs to the Faculty of Engineering at Lund University, one of the oldest and largest in Scandinavia. Lund Institute of Technology is concentrated to one place in Lund, which promotes a pleasant atmosphere among the students.

Lund Institute of Technology



Source: Homepage Lund Institute of Technology 2 (2004)

LTH offers a majority of “Master of Science in Engineering” – educations, for example programs including chemical, environmental, mechanical, computer, electrical and information-communication engineering.

LTH is connected to one of the biggest science parks in Sweden, called Ideon. The park gives non-established companies the opportunity to develop, research and growth.

### 3. LAND SURVEYING AND MANAGEMENT

“Land Surveying and Management” is an education that includes courses in engineering, law and economics. Land and its regulation into properties forms are the basic tasks in the education. Another important task for the students, at the education, is the creation and development of land information systems. The education also includes real-estate valuation and participation in the development of urban and rural areas.

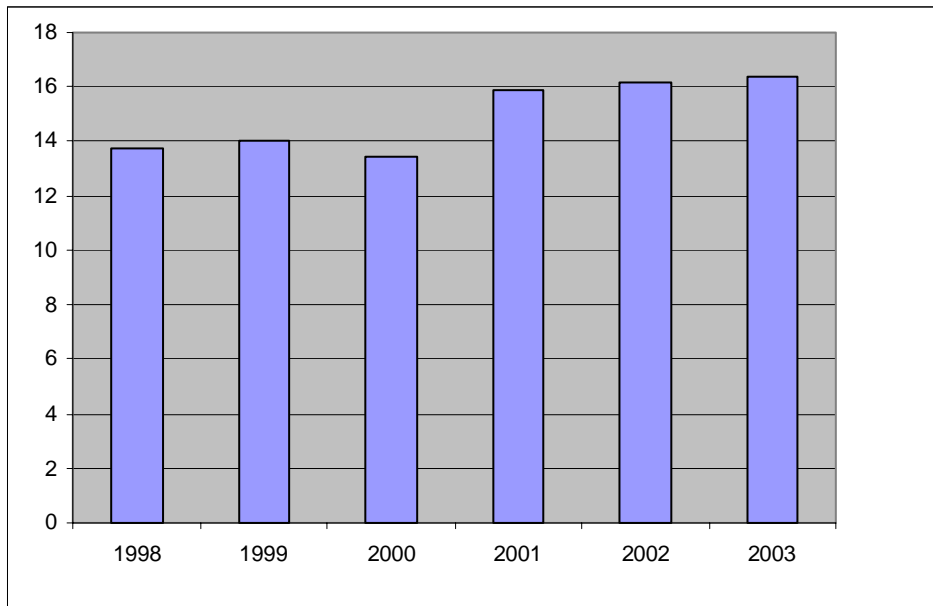
During the first three years of the education all students are studying the same courses, which include engineering subjects, law and economics. The students then give their degree a certain character through their own choice of specialised courses in the 4th year. Finally the specialisation is made by the MSc project during the last year of the education. There are good opportunities for studying and carrying out a Master's project abroad.

About 40-50 students are admitted each year and among the students there are the same number of men and women. Because of the few number of students the atmosphere between students and teachers is very good. Another advantage with being a small class is that the University has the possibility to offer the students a couple of study trips in order to enter deeply into the studies.

The education promotes the students to get involved in national and international surveying activities. The students have an opportunity to meet professional surveyors from all over the world, for example in FIG. The meetings between students and professionals help young and old, experienced and non-experienced, people from more or less developed countries to keep the “Olympic Spirit” in Surveying.

During the last years the admission points have taken a sharp increase. At this moment the education in Land Surveying and Management has one of the highest credits at Lund Institute of Technology. The diagram below shows the admission points during the last six years. Maximum amount of points is 20 and today the level of the admission points is about 16,4.

Statistic showing the admission points



Source: Homepage The Education in Surveying and Land Management (2004)

#### 4. COURSES AND TERMS

##### *Term 1*

The education begins with a fundamental term including the compulsory courses in law and mathematics, “Introductory Law and Real Estate Law” and “Calculus in One Variable”. The course “Introductory Law and Real Estate Law” deals with basic Real Estate Law and Private Law, such as Contracts, Property, Torts and Corporation Law. In this course the students get a basic knowledge in law. The other course, Calculus in One Variable, increases the basic mathematical knowledge for the coming courses. The course includes for example functions, limits and differential equations.

##### *Terms based on themes*

The largest part of the Land Surveying and Management-education in Lund is studied in terms based on themes. The meaning of the expression “terms based on themes” means that a couple of subjects are studied at the same time. The subjects are mixed in both exams and in one or more projects. This promotes an increased knowledge among the students and at the same time they learn to work in groups, teamwork. When a few subjects are brought together in a larger project the students need to use their earlier knowledge to solve the task given in the project. A lot of the projects are constructed in cooperation with public authorities and companies.

The first term starts with a theme called “Land use and the Environment”. This term includes subjects as road construction, geology, environmental systems as part of the physical

sciences, planning and environmental law. The project, which will demand integration between the different areas, means that the student will investigate the possibility to build a new Swedish highway. The influence of the highway is studied from the visual angle of the four subjects. The conclusions will result in a proposal, which shows where the most suitable place to build the way is situated. The students are also during this term reading a course in mathematics, Linear Algebra. This course contains, for example systems of linear equations.

The second term based on a theme is called Geomatics. During this term subjects like geographical information systems and classical surveying are studied. The students are learning different map-programs, like ArcView and IDRISI, and afterwards they have the knowledge to create their own maps. On the basis of the maps different problems should be solved, for example connect information to the map. This project's main goal is to make a map, which includes significant information, showing the University. Besides the Geomatics the students are studying a mathematical course, Mathematical Statistics. This course gives the basic knowledge of probability and statistics.

The third term based on a theme is the "Real Estate Information Technology"-term. The term contains the structure and development of the Swedish Real Estate Information system, including its construction and how to apply the system in countries with different conditions. Technical demands, including modelling, programming, work with databases, and how to link geographic information are also subjects which are included in this term. The project during this term will end up in a real estate information system. The system will contain information about a specific area, in this case concerning allotment gardens. A map will be connected to the real estate information system why the students have to use their knowledge from previous terms. Meanwhile the course in Real Estate Information Technology is running the students also handles two other courses, programming and mathematics. The programming course includes basic Java programming and object-oriented software development. The Mathematical course, Calculus in Several Variables, includes for example differential and integral calculus for functions of several variables.

The fourth term based on a theme is called Real Estate Economics. During this term the economic part of the compulsory education takes place. Subjects like economics, business economics and real estate economics are included in the term. All subjects are studied in a surveyor's visual angle. This means that the most important aim with the term is to penetrate economical questions concerning real estates. This term contains a couple of different projects. The projects are for example about valuation of detached houses and exploitation of domains. The projects are made in close corporation with public authorities and companies.

The last term of the compulsory part of the education Land Surveying and Management is the fifth term based on a theme. The term is called Real Estate Technology. During this term subjects like planning, suitable real estate, subdivision design and Principles of Compensation in Real Estate are studied. This term handle the law part of the compulsory education. The course includes a few different projects. The projects are comprehensive for all the parts in the term. This term also includes two study trips. During the trips different kinds of real estate areas are studied.

### *Term 7-8*

During the 7<sup>th</sup> and 8<sup>th</sup> term the students have an opportunity to specialise their education. Since everyone got their own interests there is a possibility to choose different directions. There are four different areas of specialisation.

- Real estate economy – this area consists of property market, valuation of real estates and bookkeeping.
- Real estate legislation - this area consists of legislation, practice regarding land use, land parcelling and urban development.
- Geomatics - this area consists of the construction and use of geographical databases.
- Town planning - this specialisation takes place in cooperation with students from the architect education. As the title shows the specialisation handle different types of planning and city design.

Since the specialisations consist of limited courses there is an opportunity to choose courses from all the specialisations.

### *Term 9*

The last part of the education is the 9<sup>th</sup> term which includes the MSc project. The students are allowed to spend a half year working with a special subject. The subject they choose has to connect to their earlier chosen specialisation. After finishing the MSc project the students get their degree and at the same time they are trained surveyors.

## **5. TEACHING BASED ON PROJECTS**

Teaching based on projects gives a wider perspective of the education. Instead of just handle ordinary courses, which can lead to incoherent knowledge, the students now get a more coherent knowledge thanks to the terms based on themes. The terms are similar to the future job situation since the students, when they get there, needs to use all their knowledge at the same time.

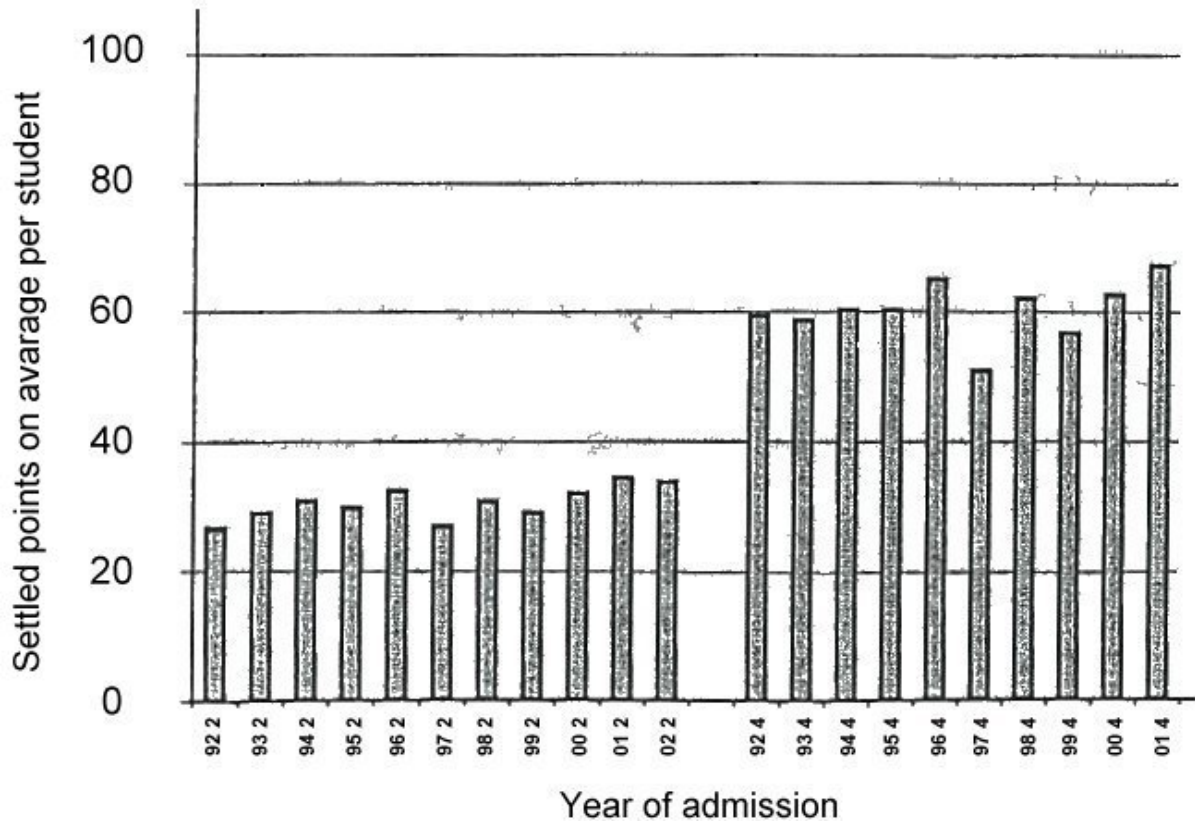
The projects are made in groups of about three to four students. The teacher who is responsible for the term often makes the compositions of students. Therefore the students learn to work with different kind of people, like they have to do in the future.

When the students are trained to project work they learn how to write a correct report and how to make a good presentation. In order to focus of the importance of this there are different guest speakers invited to talk about how to work in groups, presentation technique and leadership.

The new way of teaching leads to a higher level of approved courses among the students, which is statistical proved by the management of the education. The maximal amount of points every school year is 40 points. Before the terms based on themes were introduced the average level of points was about 30 but now it has increased to a level of 35 points after the

first year. After the second year the students who are studying in the regular way have taken about 60 points compared to the student who are studying in the new way. They have taken almost 70 points after two years of studying.

Statistic showing taken points



Source: Lund Institute of Technology 3 (2003)

## 6. EXAMPLE OF A PROJECT BASED ON A THEME

During the term “Real Estate Economics” a project including an analysis of a municipality is included. The aim of the project is to investigate the opportunity to establish three different kinds of activities:

- A new residential district with 20 real estates.
- An industry with about 50 employees.
- A large golf store with 25 employees.

Every group of students was given a certain municipality in the southern part of Sweden. The task was partly to investigate the opportunity to establish these activities in the given municipality and partly to find out the best places to establish the activities.



The building of a new residential district demands a research of the further change of population in the municipality. The students also have to investigate costs and benefits for the municipality like infrastructure, vacant jobs, childcare and other important qualities of the municipality.

When a large industry is planned to be constructed a lot of areas have to be investigated, for example disturbances, pollutions and infrastructure. A consideration whether there are further employees living in the given area also has to be taken.

An establishment of a large golf store claims an investigation of the demand in the given area compared to the existing supply in the same area. The interest of golf is also an important issue. As mentioned above the students have to investigate the infrastructure and the occurrence of further employees.

To sum up the three parts in the project the most important research is to find out the real estate conditions in the given municipality and investigate the supplies and demands for the activities.

## **7. CONCLUSION**

A change of the teaching methodology is an opportunity to improve the education results in the future. All kinds of changes have a first period when there are a few teething problems. For those who are involved in the first courses after the changes it is always a few planning mistakes to handle. But through continuous improvement and new proposals from the involved students and teachers the change of the education will develop in a better way.

The students, in the regular system, have special weeks for exams which can promote collected studying a few weeks before the exams. Workings with projects promote the students to study during the whole term instead of just before the exams. This means that the students have to work more intensive than earlier during the terms which increase the total level of knowledge. Since the terms are based on each other the different projects promote a continual repeat.

The jobs today mean a lot of team working. In this way of teaching the students gets prepared to their future work. The students get experience of working in groups. They have learned to take their own responsibility and they are used to handle different kind of problems that easy can appear in groups.

The higher level of the admission points shows that there are lots of students who are attracted to this study method. The new system has just been going on for a couple of years. Already the statistics shows that the students who are studying terms based on themes are more successful than earlier.

To sum up the new way of teaching, terms based on themes, it gives the students a better preparation for the future working life.

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