

Professional Aspects and Specificities of the Geomatic Sciences and Surveying Engineering Education in Morocco

A Unique Experience

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Key words: Education, Surveying Engineering, Geomatic Sciences, trainings.

SUMMARY

The educational program of geomatic sciences and surveying engineering in the Institute of Agronomy and Veterinary medicine Hassan II (IAV H II) is composed of theoretical courses, laboratory classes, and practical trainings, as well as studying projects and reports of end of studies. The educational system is divided into two cycles: a preparatory cycle of two years and an engineer cycle of three years.

This paper deals with the unique Moroccan experience in the domain of geomatic sciences and Surveying Engineering Education.

In the first part, we will present the headlines of the engineering educational system mainly the pedagogical and organizational aspects as specified by the law 01-00. In this context, we will discuss the distribution of pedagogical activities over the two cycles of curriculum, a two-years preparatory cycle and a three-years engineer cycle. Furthermore, we will talk about, scientific equipment, human resources, organisation of courses in modular and semester system, and the repartition of theoretical courses as well as laboratory classes.

In the second part, we will focus on the specificities and the professional aspects of the curriculum of surveying engineering program. Firstly, we will emphasize on the importance of three professional practical trainings and formulate an assessment of their impacts on national economic development. Then, we will highlight the integration of the new technologies, the continuing education, and some aspects of research and development.

Finally, we will talk about the interaction between the educational system and the Surveying Engineering profession, the major contributions of public and private partners in the educational system through their participation either in theoretical and practical courses, or through their supervision of training and reports of end of studies.

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1. INTRODUCTION

The surveying engineering education started in 1970 with an application engineer program that lasts 4 years. In 1988, due to the needs of the market, this education curriculum was transformed to 6 years program. In 2005 because of the reforms required by the higher education ministry, and the law 01-00 related to restructuring the university, the education program was reduced to five years in order to:

- allow training to adapt to the needs of different users
- take into account the needs of professionals
- take in consideration the market employment needs
- accompany the revolution due to the evolution of information technologies and communication
- form polyvalent engineers for private and public sectors as well.



This article describes the new curriculum theoretical and practical education program and traces the specificities of the unique school of geomatic sciences and Surveying Engineering in Morocco.

2. DISTRIBUTION OF PEDAGOGICAL ACTIVITIES

New educational organization refers to the book of the national educational standards. The new educational organization is characterized by an organisation of courses in modular forms.

A semester consists of several modules and lasts 16 weeks. One teaching semester contains 6 to 8 modules, with a minimum total of 448 hours. Minimum hourly volume of a module is 56 hours of teaching and evaluation. The module is fully conducted and validated within one semester.



Educational program of the surveying engineering school is divided into two cycles, a two-years preparatory cycle and an engineering cycle of three years as shown in the flowchart.

2.1 Pedagogical activities of the first cycle

The first cycle is a preparatory cycle, which consists in reinforcing the basic education of basic sciences. This cycle is divided into two years, each year contains two semesters. The

first year is common to all students of the IAV, while the second one (third and fourth semesters) is specific to the surveying engineering school.



The education program of the first cycle consists in mathematics (algebra, geometry, analysis, ...), physics (mechanics, optics, ...), computer sciences, statistics, languages skills, general education (environment, geology, geography...) and trainings.

2.2 Pedagogical activities of the engineering cycle

The engineering cycle is divided into three years. The program of this cycle covers three category of education skills distributed as follows:

- Scientific and technical education (1920 hours) : 74%
- Management education (360 hours) : 14 %
- Languages and communication skills (300 hours) : 12 %
- Total volume of hours : 2580

Scientific and technical education represents 74% of the curriculum, teaching block management education represents 14%, while the languages and communication teachings occupies 12% of the total hourly volume

In this cycle, the number of students enrolled since 2005, has known a progressively grew. Thus, registered students in first year of the engineering cycle, grows from 33 students in 2005 to 63 students in 2010.

2.2.1 Human resources

Theoretical and practical courses are ensured by permanent professors of the IAV Hassan II as well as some teachers (contractors) belonging to the professional community.



Human resources, are composed of 16 permanent professors belonging to the school, and five technicians, about 10 other permanent professors from other departments of the IAV participate to the educational program and also about 12 non permanent engineers from the professional sector participate actively to curriculum.

2.2.2 Scientific equipment resources

The school is organized into two departments: Department of Geodesy and surveying, Department of cartography and Photogrammetry. We have four laboratories, each one equipped with specific scientific and technical equipment consisting of traditional and modern instruments as well (total stations, levels, GPS, PCs, scanners, plotters, photogrammetric

stations, computer science equipment). Recently, the school has got a permanent GPS station through the cooperation with Trimble company.

3. SPECIFICITIES OF THE CURRICULUM

We can summarize the specificities of the curriculum as follows:

- The program of education covers Geomatic sciences and surveying engineering
- It is Openend to new Space technologies and data management, communication
- The program is regularly updated, which allows the engineer to perform his role as prime actor and producer of geographic information.



The program is designed to give to future engineer a polyvalent education which will enable him to work in any department (agriculture, habitats, roads, urban and rural management, ..).

The components of the curriculum are based on professionalization: in this context the curriculum can be subdivided into three categories which contain theoretical and practical lessons as well. The practical part covers around 30% of the total timetable volume. The three categories of courses are described in the paragraphs below.

3.1 First category: technical and scientific education Courses

3.1.1 Photogrammetry and remote sensing courses

Fundamental Photogrammetry, remote sensing thematic applications, Physics of remote sensing, photo-interpretation, Stereophotogrammetry, Aero-triangulation, digital photogrammetry.

3.1.2. Cartography and GIS courses

Cartographic Projections, computer assisted drawing and cartography, Cartography, Thematic Cartography, Infography, printing technology, digital terrain model, GIS, spatial Analysis, database, project of geomatic.



3.1.3 Cadastre & surveying courses

Fundamental surveying, surveying Procedures, Management of cadastral Technics, digital surveying, road and art structure surveying, project of surveying

3.1.4 Geodesy courses

Gemoetric Geodesy, Astronomy and cosmography, adjustment Computation, spatial gedesy, GPS, prcise levelling, physical geodesy, metrolgy & control stability, geophysics.

3.1.5 Related Professional education

Consolidation, hydraulics, geomorphology, urban and rural management, roads techniques, sanitation, cicil engineering techniques, Land and Real estate Expertise, Agricultural Water Management,

3.2 Second category : management courses

Micro Economics, General Economics, Civil Law, land law, cadastral management techniques, administrative organisation, Accounting, Market State Budget and Public Finance, Project Management, Business management & marketing, professional Law, planning law, planning cadastral information management, System of Quality Management.

3.3 Third category : languages and Communication Skills

French, english, communication skills in french, communication skills in english, synthesis technics in french, synthesis technics in english, writing texts in french, writing texts in english.

4. CHARACTRISTICS OF THE PRACTICAL EDUCATION PROGRAM

Practical education part of the engineering cycle occupies around 30% of the curriculum, it contains laboratories, projets, trainings, seminars, studying visits and the project of end of studies.

In this context we distinguish three trainings :

- the "cadastre training"
- the "professionalization training"
- the "enterprise training"



The time, place and manner of the projects and training are summarized in the table below.

4.1 Training in Cadastre

This trainig lasts three weeks, two weeks within a Cadastre Service, and one week within a land registration service. This training is designed to familiarize students with the work carried out by various departments of these institutions.

| Table : summary of practical trainings and projects | | | | |
|---|---|------------|-----------|---------------------------------------|
| YEAR | NAME | FIELD TIME | LABO TIME | PLACE |
| 1 ^{ère} year | Surveying project | 6 days | 4 days | Campus - Rabat |
| 1 ^{ère} year | Cadastre training | 3 weeks | | Cadastre & land registration services |
| 2 ^{ème} year | the «professionalization training in geodesy & surveying « | 4 weeks | 2 weeks | Different régions of the Kingdom |
| 2 ^{ème} year | « Professionnalization training in cartography & photogrammétry » | 1 week | 2 weeks | Different régions of the Kingdom |
| 3 ^{ème} year | the « enterprise» training | 30 days | | private firms & Semi-public Sector |
| 3 ^{ème} year | Geomatic project | 2 days | 5 days | |

4.2 The "professionalization training “

This is the most important practical training of the engineering cycle. The objective of this training is to practice concrete projects of Geodesy, surveying and photogrammetry

The duration of this training is five weeks in the field. Once the field works are achieved, students spend at least two weeks at the Office to make data treatment, analysis, report writing and presentation in front of a jury.

The « professionalization » training is carried out annually in a region of the kingdom of Morocco in coordination with the services of the national mapping agency and local communities.

This training takes place at the end of the second year of the cycle of engineer. This training includes the densification of planimetric and altimetric geodetic infrastructure equipment network, stereo preparation and surveying with GPS and total station as well. In General, these works are carried out on a real project which will be used for the development of a local community.



Conducted field works consist in : triangulation, traverses, GPS observations, precise and geometric levelling, use of total stations for surveying and stereo-preparation. these works are within groups of four students under the supervision of professors.

4.3 The “Enterprise training”

This last training is designed to prepare students for insertion into professional life. This is another opportunity to implement the theoretical lessons acquired during the student’s curriculum. The training can be done in the public sector, semi-public or private sector. This

TS01H - Curriculum and Core Survey Knowledge I, paper no 4925

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training takes place in the first half of the third year of the engineering cycle, for a period of one month.

Among the companies participating in the student monitoring during this training: several private surveying offices, urban agencies, the administration of highways, the Department of roads and road traffic, some abroad firms or institutions (especially in France and Belgium).

4.4 Impacts of trainings on national economic development

Major projects realized within these trainings are done in collaboration with local communities, their objectives are real project of development, during the last five years the results of the realized projects were used to:

- The determination of 29 New geodetic points to Strengthen the network of Geodesy
- The determination of 168 New traverse points for Cadastre use
- The determination of 29 new precise leveling control points
- Urban Development

The photogrammetric and surveying maps realized in these trainings have served to:

- Sanitation works for two local communities
- Setting up water pipes of two municipalities
- Management needs of the streets of one municipality
- Development of infrastructure of two municipalities
- Agricultural development of two rural centers
- Promote mountain tourism of three rural centers



4.5 Synthesis project

Synthesis projects are aimed to implement technical methods and procedures acquired during the theoretical and practical courses, including methods of surveyings, cartography, GIS, remote sensing and Photogrammetry.

4.6 Studying visits

These kind of visits are intended to show the works realised within laboratories of production, printing of maps, digital mapping, Photogrammetric restitution, archiving maps, and so on.

studying visits include also offices such as dam buildings and Highway building administration.

4.7 Seminars

Seminary themes concern: ethics of the profession, problems related to the exercise of the profession (law 30/93), marketing, law societies, Internet & GIS, expropriation, land expertise and GPS permanent stations.

4.8 End of studies project.

End of studies project is a personal work where the student invests full-time to study a topic or carry out a practical project in one of the disciplines within the fields of geomatics and surveying engineering.

Topics are identified and defined by the professors of the school in collaboration with partners in the sector.

This Project of graduation takes place on the second half of the last year, it consists of writing a document that reflects bibliographic study of the theme studied, presentation and analysis of the results and recommendations.

Finally, student engineer must defend his work publicly in front of a jury composed of researchers-professors from the school and professionals coming from outside.



4.9 Continuing education

The school gives importance to continuing education in order to follow the rapid technological evolution. Thus, each year the school organizes Continuing education courses dedicated to meet the needs of the professional environment.

The themes of continuing education program carried out between 2006 and 2010 are : Road projects , Arcinfo, remote sensing, GPS for cartography, geodesy and surveying, satellite imagery, Covadis 2D & 3D, and digital photogrammetry.

5. INTERACTION BETWEEN THE EDUCATIONAL SYSTEM AND THE SURVEYING ENGINEERING PROFESSION

The school has several partners at national and international levels. The two main partners are the National Agency for Land conservation, Cadastre and Cartography (ANCFCC) and the National Order of Surveying Engineers (ONIGT)

The school has a cooperation agreement with the ANCFCC that consists in continuing education, conduct research development programs and scientific activities.

The school has also concluded a Student sponsorship agreement with the ONIGT: this is another formula to the professionalization of students. It consists in coaching students during school and after their graduation. Thus, it was agreed in the context of this Convention that each student is sponsored by a private enterprise during his studies. The sponsored student shall receive a compensation scholarship for the duration of the contract. The sponsored undertakes to comply with directives of the sponsor and observe the utmost discretion to professional secrecy. After his graduation, the sponsored undertakes, working within the enterprise of the sponsor for a period defined by the contract commitment letter.

6. PARTNERS' CONTRIBUTION IN THE EDUCATIONAL SYSTEM

There exists a great relation between the public, private partners and our school. This relation can be expressed by the participation of these professionals in the realisation of the educational activities.

- 100% of the related professional courses are ensured by engineers from private and public sector
- 50% of the management courses are taught by professionals
- The training in cadastre is entirely supervised by a staff from ANCFCC
- The enterprise training is totally ensured by the private companies
- Studying visits are also prepared and supervised by staff from the professional sector
- Lastly, some private and public engineers participate to the supervision of 30% of the end of studies projects.



7. CONCLUSION

The school of geomatic sciences and surveying engineering is the unique school forming surveying engineers in Morocco. The school's staff is composed of professors that have got their doctorate diploma from Canada, USA, Belgium and France.

The school has a large and unique experience in the domain of education. Up to 2010, the school has formed more than 1000 engineers; around 5% of them are from Africa.

The engineers of the school carry out their professional activities in private companies and in different public services such as: agriculture, roads, equipment, municipalities, habitats, urbanism as shown in the figure below.



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BIOGRAPHICAL NOTES

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1979: Diploma of engineer in surveying from IAV Hassan II, Rabat, Morocco

1986: Master of Science from Ohio State University, Columbus, USA

1999: Doctorate of Sciences from the University of Liege, Belgium.

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