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Planning, implementation and evaluation of a new academic curriculum: the case of the Geoinformatics and Surveying Department at the TEI of Serres

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ABSTRACT: In this article, the author seeks to assess the design, development and three-year operation of a new course curriculum in applied technology in a Greek Technological Educational Institute (TEI). The constant increase in demand for spatial information and the technology for managing this information provided a challenge in forming an independent undergraduate academic curriculum in applied sciences, similar to other departments in peer European and worldwide academic institutions. In the article, the author analyses the structure of the curriculum and the methodology behind its design. Quantitative data from the first evaluation of the operation of the Department at the TEI of Serres is also presented, along with data from a survey was conducted on students of the Department. The survey explored the way that current students evaluated the academic curriculum's structure and the benefits it afforded them. The results of the survey revealed that a strong appraisal of the new academic curriculum seemed to be the case for the student, academic and professional communities in Greece.

INTRODUCTION

Any decision-making process presupposes the necessary infrastructure of relevant information. *Information* may be defined as the result of any form of processing of data. The organised set of equipment, processes and management methods that collects, maintains, processes and updates data, as well as creates information, is called an *information system* [1]. Information systems that collect, classify and recall information and data concerning the natural reserves of the Earth are called *Geographical Information Systems* (GIS). The basis of a GIS is a single system of geodesic reference, which facilitates the correlation of data within a system and other systems that contain data about the Earth.

In fact, a GIS is a decision-making tool for administrational, economic, technical and legal purposes, as well as an instrument for spatial planning and development. Such a system is made up of databases containing space-specific data related to the natural reserves of the Earth, and of procedures and techniques for the systematic management of spatial information [2][3]. Today, GIS technology keeps progressing and is becoming more user-friendly, despite the lack of well-trained managers in this field (at least in Greece).

This kind of management of spatial information, which keeps increasing through new technologies, seems to be turning into the main goal for decision-making agents and, consequently, creates a new cognitive and educational field. It should be noted that both this discipline and the methodology of educating students (undergraduates, postgraduates and adults) have, in recent years, been analysed by various researchers [4].

Keeping the above in mind, an academic course was organised in the Department of Geoinformatics and Surveying, which was first offered to students attending Greek tertiary technological education courses in the academic year 2000-2001. The planning of an undergraduate course of studies in the discipline of Geoinformatics – which, until then, had only been offered as a postgraduate option – goes hand-in-hand with the recommendations of eminent scientists of this field and reflects the development of the discipline over the last decade. Academics in the field have argued the following:

> *The traditional custom of including the cognitive subject of GIS in the Departments of Geography, Sciences or Information Technology should be replaced by creating independent undergraduate departments of applied studies* [5].

THE SUBJECT MATTER OF THE DEPARTMENT

The aim of the new Department incorporates an inter-disciplinary approach of geo-sciences, so that through a structured body of knowledge, technological skills and practical experience, the concept of technological engineering is promoted. Scientists of this field should be capable of providing technical solutions, taking into account economic and environmental aspects that will be documented in a modern, electronic manner. More specifically, the course aims to develop the following skills and competences among students:

- The creation, maintenance and updating of an appropriate mapping background on topics of surveying, geodesy, cartography, photogrammetry and tele-surveillance.
- The generation, maintenance, updating and correlation of possibilities among databases, such as those containing geological, cadastral, urban, environmental, demographic, statistical data, etc.
- Data processing using mathematical, statistical and algorithmic methods.

- The development of the ability to establish relations by liaising with various fields (eg national cadastre, urban planning and implementation acts, road construction and infrastructure networks, rural districts, the distribution and re-allotment of land, etc), which will support the organisation of urban areas, environmental planning, ecology and sustainable development.

As reflected in the title of the course, the approach of geo-sciences (GIS, GPS, cartography, urban planning, etc) is based on the background knowledge of surveying. This is considered fundamental for the education of a technological engineer of geo-sciences.

THE PROCESS OF PREPARING THE COURSE

Course Structure

The course was structured on the basis of the objectives developed above, taking into account the following:

- Greek educational experience at Institutes of Further Education (IFE) [6][7];
- The criteria of the State Institute of Technological Education concerning the control, evaluation and assessment of educational courses [8];
- Relevant current literature [9];
- Experience of peer European academic departments [10].

The team that prepared the course included members of various academic institutes and was interdisciplinary in regards to the cognitive fields of its members. This was so as to safeguard the most objective and comprehensive view of the course, which is, in any case, an unconventional, innovative field of applied technology.

The preparation of the course curriculum, which is to be analysed below, was organised in four overlapping phases, with feedback from each other [11]. The first phase was a brief pilot development of the course that accompanied the initial proposal for the establishment of the Department. The second phase concerned the analysis of international practice and the planning of the course curriculum and syllabi, while the third phase was the pilot implementation. The fourth phase recorded the course impact and acceptance by students, the academic sector and the labour market on the basis of a questionnaire and included corrective interventions leading to its finalisation.

THE COURSE CURRICULUM

The course duration is eight semesters and comprises 40 different modules common for all students who are all awarded the same degree. The first seven semesters comprise the taught part of the course. In the final semester, students are required to take six months in a practical placement while also pursuing their final year dissertation. Teaching is a combination of lectures, fieldwork, case studies, and individual or team projects. The modules are divided into four groups, as follows:

1. General background modules (GBM);
2. Specialised background modules (SBM);
3. Specialisation or concentration modules (SM);
4. Management, economics, law and humanities modules (MELHM).

The extent to which each of these categories is taught is shown in Figure 1, illustrating the prevalence of subjects of groups 2 and 3.

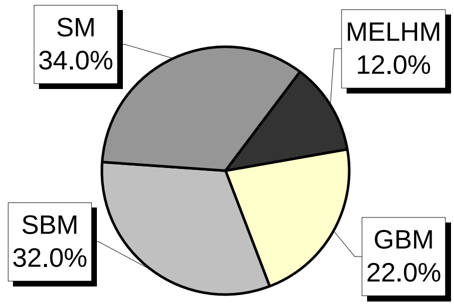

Figure 1: Percentage of subjects per group.

However, a more detailed examination of sub-groups 2 and 3 reveals that there are three categories of cognitive fields developed, namely the GIS field, the surveying field and the urban and spatial planning field.

Furthermore, during the last semesters of the course, there are six subjects from which three are elected as core subjects (concentration electives). Apart from the compulsory core modules that the candidate has to take, there is also a variety of optional modules. They are either overspecialising modules or involve other sciences that are indirectly related to GIS. The number and type of optional modules vary and are announced at the start of every academic year.

Teaching the subjects mentioned above requires a total of 170 teaching periods, which are distributed over the seven course semesters. Of the 170 periods, 80 periods (ie 47.06%) involve laboratory-based instruction. The relationship between the laboratory-based and the classroom-based instruction seems to be very balanced (see Figure 2).

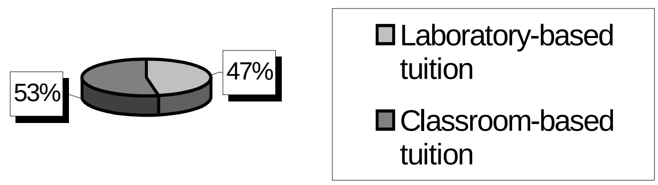

Figure 2: Ratio between classroom-based and laboratory-based instruction.

As seen in Figure 3, the laboratory/theory ratio is increased in comparison to other departments in the Faculty of Applied Technology at the Technological Educational Institute (TEI) of Serres, and is comparable to that of the relevant new Department of Information Technology and Communication at the TEI of Serres. The increase of the total laboratory session periods was considered necessary in order to better disseminate new documentation technologies and spatial data management, which forms the backbone of the new Department.

Developing the syllabus for each subject was a demanding task. Efforts were made to avoid the overlapping of various syllabi, to make reference to contemporary literature (of the last five years), and to achieve a logical sequence and complementarity among various subjects [12]. An adequate number of prerequisite/interdependent subjects were also sought. The syllabus of each course is combined with practical exercises and projects prepared by students in the teaching rooms, the laboratories, the tutorial room, the library or at home. In this way, the interest of students would remain high, participation encouraged, and students' ability to seek information and knowledge, both individually and in small groups, nurtured.

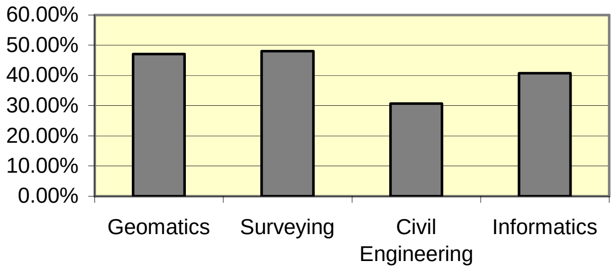

Figure 3: Percentage of laboratory sessions in other academic departments.

A total of 30 credit points has been allocated for each semester of the course. Ten of the credit points of the last semester concern the final dissertation and 20 for the practical experience stage. Credit points were distributed per subject on the basis of the workload that the student had to undertake in order to be able to complete successfully the course requirements. The curriculum also states the equivalence of the teaching periods of each subject per week to the credit points of the European Credit Transfer System (ECTS).

In summary, the development of the curriculum was based on three concepts, namely: the promotion of new technologies, flexibility and an interdisciplinary approach.

GRADUATE PROFILE

According to the curriculum described above, graduates of the Department of Geoinformatics and Surveying may use methods of land surveying with conventional or satellite location systems – either independently or in combination with photo-grammetry and tele-surveillance – in order to be employed in the following fields:

- Geographical Information System through entering, maintaining-processing data and drawing results, conclusions and thematic maps;
- Surveying, through preparing of surveying records and undertaking general surveying tasks within and outside inhabited areas;
- Transport projects through town planning and street-layout studies, preparation and management of simple case studies and the implementation of corresponding projects, depending on the legislation in force for each case.

DEVELOPMENT OF THE DEPARTMENT: THE MANAGEMENT MODEL

There was a need to comprehend and optimise the operation of the new academic Department; this has been obvious since the very beginning. Equally self-evident was the need to use a management model that would be both stable and easily comprehensible for everyone involved in the Department.

Various studies have revealed the mechanisms of operation for academic institutes and their departments [13]. However, it was only recently that researchers focused their attention on identifying concepts of organisational behaviour (such as *team* or *teamwork*) in the overall operation of academic institutes [14][15]. As expected, the next step was for the interest of researchers to be drawn to the basic academic administrational unit, ie the academic department [16]. The academic department is responsible for services such as teaching and research [17][18]. As such, it is a hub that connects various cognitive fields and the institute, a tool for developing and improving services.

In light of the above, a management model similar to those used in business management, especially that of non-profit making companies, was developed [16]. This model included the creation and continuous coordination of various independent action teams, such as those of planning, of technological infrastructure, or communication with professionals in specific cognitive fields, self-evaluation, etc. It is self-evident that the persons involved undertook numerous roles, which also kept changing. It is also self-evident that new action teams were added as time went by; some changed while some became less active or stopped existing. Finally, as the Department acquires new academic staff, this model will naturally change or develop.

PERFORMANCE OF THE DEPARTMENT THUS FAR (2000-2003)

Students

The first 221 students entered the course through the Pan-Hellenic Examination System in the fall semester of 2000. As can be seen in Table 1, the ratio of active/registered students remains exceptionally high.

Table 1: Number of active/registered students.

Academic Year	Registered	Active	% Active Students
2000-2001	221	204	92.31%
2001-2002	180	158	87.78%
2002-2003	191	187	97.91%

In analysing the student profile, it can be observed that a slightly higher number of males enrolled; for example, in the academic year 2003-2004, of the 108 students who registered, 56% were male and 44% were female.

The Teaching Staff

Concerning the teaching staff employed, there were 16 tutors (academic year 2000-2001), 28 tutors (academic year 2001-2002) and 42 tutors (academic year 2002-2003). In the academic year 2003-2004, there are 42 tutors employed, with an average age of 34. As for their academic qualifications, 15 hold a doctorate, 12 have completed a postgraduate course, 10 are Further Education Institute graduates with long professional experience, and five are young researchers (doctorate candidates, etc). It is obvious that the Department attracts competent academic staff.

Infrastructure/Services

Concerning technological infrastructure and laboratory equipment, the necessary software and instruments have been supplied for the following laboratories: surveying, GPS, GIS, cartography, photogrammetry and tele-surveillance. A rich lending library was organised with multiple copies.

Parallel Activities

A course manual was published for the Department, both in hard print and CD formats. A Web page was designed and is being constantly updated (www.teiser.gr/geomatics). The teaching staff post both marks and tutorial notes on the Web site. Scientific lectures, educational trips, participation teams for conferences (eg students participated in the conference of ARCInfo users, the *10th Pan-Hellenic Cartography Conference*, etc), participation with a presentation at three consecutive infosystem exhibitions, etc, have also been organised. Additionally, posts have been sought for the practical experience stage of the first senior students.

INITIAL EVALUATION OF THE OPERATION OF THE DEPARTMENT

After the second year of the Department's operation, a special scientific team was delegated to evaluate the operation of the Department so far. The team included eminent academic staff from universities and technical education institutes from related cognitive fields, as well as representatives from industries. An evaluation report was produced and presented to the Ministry of Education [19]. The remarks made were taken immediately into consideration in order to ameliorate the quality of the education offered, to improve the interconnection between subjects and to fully exploit the equipment acquired in the meantime. Figure 4 shows the order of preference for the Department.

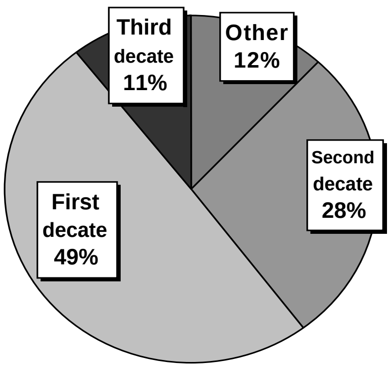

Figure 4: Order of preference for the Department.

Further to the experts' report, a research questionnaire addressing students was also administered [20]. This included two groups of questions: the first concerned students' personal data while the second covered the views of interviewees on their course of studies and the process of selecting the specific department for their undergraduate studies. The questionnaires were distributed to students during a laboratory session in a teaching week, so as to ensure maximum participation. Only those absent during the specific session did not answer the questionnaires. In the 312 questionnaires collected, there were 14,300 recorded multiple choice or yes/no answers. Interesting data were revealed from the questionnaires, including that the Department had been among the top 10 choices of their computerised entrance form for about 40% of those surveyed.

Another important finding was that the students were aware of the fact that the structure of the course comprises four interconnected topics/cognitive fields. Thus, a large percentage of those asked ranks the four topics/cognitive fields of the course in order of importance (see Figure 5).

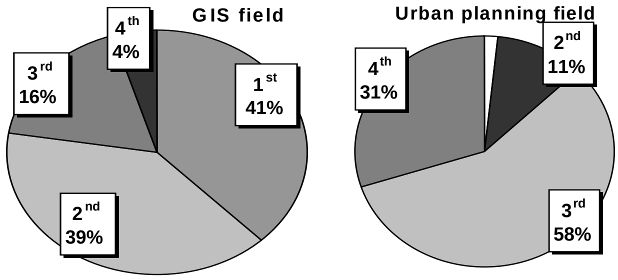

Figure 5: Ranking of the cognitive fields of the course.

In other words, the basic objectives of the course were recognised by the Department's students and the overall image of the Department, on the basis of the questionnaires, was evaluated as *very good* to *fairly good* by 57% of those asked. Figure 6 reflects the overall image of the Department from students' viewpoints.

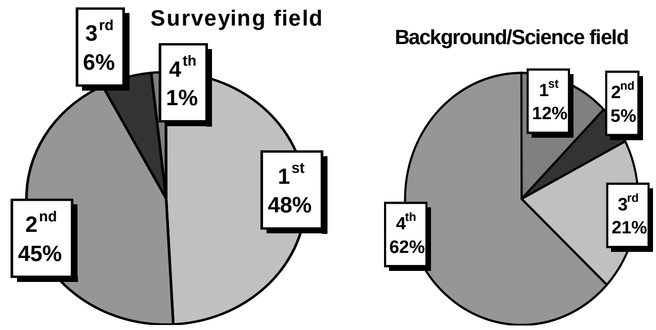

Figure 6: Overall image of the Department (students).

A second questionnaire was prepared to address teaching staff and associates, so as to record the views of professionals in the specific field, as seen by those who implement it. Questions covered an evaluation of the Department's organisation and infrastructure, as well as an evaluation of all course modules and each module individually. From the total of extra teaching staff of the Department, 512 answers were recorded on multiple choice (five-point scale) questions. It is impressive that no *mediocre* nor *bad* responses were found. The overall image of the Department from the viewpoint of the teaching staff is displayed in Figure 7. When compared with Figure 6, it can be perceived that tutors have a better overall *picture* of the course than students.

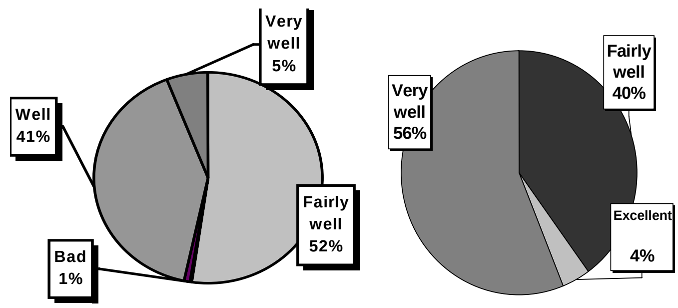

Figure 7: Overall image of the Department (tutors).

Although this is easily explained on the basis of the different roles they are asked to play in the teaching process, it should be noted that this is the next objective to tackle. In other words, actions should be developed (through communication methods or by re-organising the material of subjects offered, or through both) so that students acquire a *clearer* picture of the study course they are attending.

CONCLUSIONS

This article is aimed at presenting the reasons behind the establishment of the Department of Geoiformatics and Surveying at the TEI of Serres. The author has analysed the cognitive field of the course, the structure of the course curriculum and the methodology that supports its content choice. Finally, data has been presented from the first evaluation of the operation of the Department and the field study carried out concerning whether and how students themselves perceive the cognitive fields offered and how those involved in teaching evaluate the educational process. Data processing indicates that acceptance by both the student community, tutors and employees have tended to be established; therefore, new schemes of cooperation for postgraduate studies, aimed at deepening the course, continues to emerge.

A study course curriculum for tertiary education must be planned as an *open system* that is capable of change and adaptation to new developments (which are truly radical). As such, the flexibility aspect of the course in the sectors of Geographical Information Systems and spatial development has to be emphasised. There are, indeed, numerous alternative approaches, but the definite restrictions of the Department's small executive team allow a margin for welcomed reviews of this effort [7].

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