

Designing a new open training offer for the development of GIS skills in the French Department of Agriculture

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Abstract

Due to the quick development of Geographic Information tools, the public administrations have been lead to design specific projects (including training programmes for their staff) to develop a rational use of those technologies.

Thus a project called “GIS Open Learning for the French Department of Agriculture” (FO-SIGMAP) was initiated to allow an “individualisation” of training paths, making training offers clearer and more flexible; it is also aimed at giving all the staff a ‘common technical culture’ in GIS topics that could allow the services of the department to enhance the coherence of their skills and activities.

This ongoing project (it will conclude in end 2005) is driven through a methodological approach based both on the granularisation of the training contents and the adaptation of the educational aids and sets to the concrete limitations and constraints of the audiences; more specifically, the designing of open learning sets will allow offers to be performed either in training centres or inside the administrative offices.

First intermediate results confirm the interest of such an adaptative approach.

Context and objectives

The rapid developments over the last several years in the use of geographical-information methods and tools have been acknowledged by the French Ministry of Agriculture and have resulted in the setting up of a comprehensive mechanism that includes the integration of GIS in the Services Information Systems and in the Master Plan, the setting up of a Geographical Information department within the Ministry’s Administration Directorate and of an operational human network for implementation in decentralised services. This mechanism has an important ‘training’ component whose endeavour it is to develop and co-ordinate the Ministry’s schools’ training offers on the subject. This mechanism has led to a substantial growth in the number of agents trained through the development of classroom training programmes of several days’ duration that are designed to fulfil various training requirements (training of decision makers, of GIS project leaders, of advanced users, etc.).

However, this mechanism suffers from several limitations:

Even though the functional skill requirements of the services are relatively homogeneous, the needs and specially the training paths (proposed or completed) can vary widely depending on parameters relating to the trainee agent (pre-acquired knowledge, personal limitations) or to the service (project approach, specific local requirements).

While implementing projects of the services, the training efforts should be recognised and managed by the monitoring of the training programme’s progress (acknowledgment and validation of acquired skills, noted in personnel careers).

As a component of a comprehensive mechanism for the development of new practices and for the improvement in the quality of the services offered to the population by the Ministry’s activities, the management of the training programmes should be made more interactive, both upstream (during the preparation of the training offer) as well as downstream (evaluation of the training’s effects on the agents’ skills).

It is therefore advisable to aim for an individualisation of the training syllabus, rendering the training offer both accessible and flexible. At the same time, the staff of the Ministry of Agriculture should be encouraged to share a common technical culture as far as GIS matters are concerned. This will lead the services to improve the consistency of GI/GIS skills and activities.

This project's objective is, therefore, to develop a pedagogical engineering approach that permits the structuring of an integrated architecture of continuing training of staff in Geographical Information.

The existing training mechanism's constraints and limitations (classroom-only training, lack of flexibility with respect to local contexts, not adequately taking into account staff sensitisation and the training of decision makers) have to be overcome. Towards this end and within a conceptual-experimental framework, the project aims to arrive at a proposal, validated at the technical and pedagogical levels and destined for the decision-maker/manager of the continuing training programme of the ministry's staff, for the deployment of an innovative staff-training mechanism including all necessary validated operational tools.

Approach and method

The selected approach is drawn from the methodological references based on the granularisation of the training contents, a process that allows the modularised creation of pedagogical tools and training situations – a measure of the final training offer's flexibility and adaptability (Bazile P., 2004).

Four stages are thus proposed:

1. Pedagogical engineering and technical choices:
 - Analysis of skill requirements,
 - Structuring of the 'granularised' training contents,
 - Analysis of the desynchronisation of the training requirements (in time and space) resulting from organisational, individual and pedagogical constraints,
 - Design of open mechanisms integrating these requirements,
 - Technical choices for implementing and launching the training platform.
2. Developing the mechanisms, choice of sites and experimental services:
 - Adaptation of existing modules and tools for the structuring of content and for the proposed pedagogical mechanisms,
 - Integration of the tools into a remote-learning platform,
 - Development of training protocols and programming of test sessions,
 - Training of trainers and tutors.
3. Implementation of training programmes and finalisation of products:
 - Conduct of training programmes,
 - Session assessments, evaluation of tools and products,
 - Finalisation of products.
4. Summary and assessment:
 - Assessment of the operation,
 - Drafting of summary documents and a methodological guide (distribution and generalisation of results),
 - Proposal for the deployment of an operational system.

The trainees should be able to 'follow' the training, either from the schools and training centres (initial training of future officials) or from computers in the Ministry's services.

The proposed 'remote-access' system will be based on a dual-server architecture:

- A training platform (Ceres Form@gri) which will be accessible by the students and trainers. This platform shall include tools for creating training syllabi, interaction (chat, forum), and for monitoring the individual syllabi by the trainers.

- A separate server for pedagogical resources managed by the trainers. The syllabus and the activities prescribed to the students shall point to these resources.

In addition, for doing the hands-on exercises and case studies, the trainees shall have access – either at their workplace or at training centres – to computer terminals equipped with the MapInfo GIS software application. The data sets necessary for these practical exercises will be available to them on the schools' Intranet or that of the Ministry's services.

This technical set up will ensure that 'configurable' training can be conducted by the trainer. He can suitably adapt the training offer by using the mechanisms, more or less open, depending on the target audience's limitations (Haeuw F. & al., 2001).

Preliminary technical work is necessary at the following two levels:

- The testing of solutions and formats for interactive online resources:
 - o Production of online products from offline products (PowerPoint presentations, etc.),
 - o Richmedia solutions, incorporating different formats (videos, text, presentations) into one scenario,
 - o Solutions for online GIS services (ArcIMS applications in particular)
 - o Solutions for the development and management of quizzes, and the monitoring of the training programmes' progress.
- Analysis and compatibility testing of proposed tools and architecture with the organisation and Intranet-security systems of the Ministry's services.

Four complementary issues

1. Training of, and providing support to, decision makers (target audience: managers)

The target audience of managers is of special strategic interest. Their motivation and involvement is of paramount importance for the successful implementation of innovative methods and practices; they have to be convinced of – and become votaries of – the issues and implications of changes at this level.

This has been confirmed, without exception, in all experiments conducted in various organisations while deploying GI(S) projects. Thus the StrateGIS project, dedicated to the deployment of Geographical Information tools in public administrations in Sweden, has been designed for training, a priori, the decision-makers (StrateGIS, 2001).

As of date, the training offer on the subject is limited to a classroom programme conducted, over the last several years, by ENGREF (so called 'GIS: issues and approaches'); this programme, even though otherwise satisfactory (participant assessment is very positive), comes up short because it largely misses this target audience (only 20 % of managers, the majority of the attending audience being GIS or IS project leaders).

No doubt it is difficult to mobilise this type of audience for traditional training programmes but that is not the only reason. We have to conduct an in-depth analysis, even more than for other target audiences, of their perspectives, their expectations, their motivations and their limitations.

Their positions are those of strategists and managers; they delegate not only the technical management but also the conduct of projects. It is, therefore, unrealistic, for example, to offer them a highly technical introduction (on the tools, on the applications deployed, on data structuring, etc.), subjects that will concern more the information-systems technical staff (IT and GIS specialists).

For this task, it will be useful to work in liaison with a grouping of external services Heads and the think tanks set up inside those groups. This should make it possible to stick to the context and to the requirements of the managers.

2. Sensitisation of personnel (target audience: all the agents)

This task involves the necessity of informing and motivating the personnel and a necessary common entry point for an integrated continuing-training system and for development of skills of the staff more directly involved in the use of these methods and tools within their professional activities.

For this target audience, the technical systems implemented will have to be reduced (no requirement of any pre-knowledge or specific additional study, such as using a training platform, for example). The traditional or online pedagogical products should be intuitive to use and easy to manipulate, the pedagogical sequences short and lively.

In terms of educational situations, it seems unrealistic to propose an approach using classroom programmes organised in the schools: this 'module' should be conducted as close as possible to the personnel and the services, including in asynchronous or partially asynchronous situations.

3. A 'common GIS culture' (**target audience: all agents in contact with geographical information**)

This point appears essential in the overall mechanism:

- Agents of the Ministry's operational services who deal with geographical information should work on the basis of a common technical and methodological culture concerning the fundamental concepts of geographical information, its management, its place and significance in the information systems of the services. This aspect concerns, in a complementary manner, both the Master Plan of the Information Systems of the Ministry's services and the local context (the territory is a 'structuring' component of a departmental or regional service, as are the partnerships and shared projects on this territory).
- This common culture should also become a fundamental element of the training programmes in Geographical Information.

This task could, in terms of training offers, either take the form of a 'stand-alone' module which will be conducted nearer the services (course to be managed locally or regionally, to be divided between face-to-face and partially asynchronous sequences) or be integrated into a training module for the mastery of concepts and tools (as is done currently in the face-to-face course 'Practice of GIS' performed in schools and training centres) whose modalities could be diversified if necessary (cf. below).

4. Introduction to, and mastery of, software tools (**target audience: any agent handling geographical information**)

This task is based on ongoing development work, already done within the framework of classroom programmes, and which consists of developing:

- Clearly defined pedagogical references (objectives of knowledge and skills, sequencing of a session),
- A set of distributable pedagogical tools (presentations, worksheets, data sets for exercises).

The offer will be imparted flexibility by the desynchronisation of training situations, allowing it to be individualised and made more adaptable.

The following declinations are proposed:

- Pre-training services that allow the eventual trainees to remotely acquire basic knowledge on the subject to help them prepare for the training and thus better use classroom time to grasp methods and tools.
- Post-training services that, as continuation of the classroom programme, reinforce and consolidate the skills acquired during the programme and put them to practical use.
- An online set that allows agents to remotely upgrade their skills at their own pace, depending on their knowledge level.

This last mechanism could allow the creation of a 'user' level and a specific online system for validating acquired skills. This level could also be made a pre-requisite for some advanced programmes (in-depth technical subjects, project management, localised-data management).

Finally, this last task should include the specific objective of the initial training of the Ministry's future executives. This project, already at an advanced stage, will be presented in detail in the rest of this article.

Task no. 3 seems to be the most important of these last three tasks and one around which the others will revolve. It should be clearly defined in its contents and objectives; the definition of open references for training in a 'Common GIS culture' is strategically important to the entire mechanism.

Moreover, this pedagogical reference frame should be 'granularised' so that it imparts flexibility in the structuring of varied training sequences or sessions:

- 'Teaching' contents broken up into 'elementary' granules,
- For each granule, developing of declinable tools (in size and in form).

The final products expected to result from these four tasks are:

- An 'open' training reference per task,
- A bank of pedagogical tools accessible online, complemented by a methodological guide for the users (schools, presenter-trainers at the local or regional levels),
- Strategic specifications of a structured mechanism to be deployed: elements of a diversified offer, implementation constraints and modalities, organisations to be set up (co-ordination, training of trainers and tutors, management of the validation processes).

First intermediate results

1 – Creating an open reference frame for 'Common GIS culture' training:

The analysis of requirements of staff and earlier experiences (evaluation of training sessions, presentations and local training) have led us to develop modular and declinable content in five 'Elementary Content Units'.

- Geographic Information and GIS
- Geographic data
- Creating and updating geographic databases
- GIS methods and tools
- National and local context

These granules are outlined in Appendix n° 1.

Specifications for the production of pedagogical tools are currently being finalised and concern:

- Face-to-face presentation tools (PowerPoint, short text documents).
- Online presentation tools (accessible with a Web browser).

2 – A remote skills-upgradation module for future departmental heads:

This development of this module is related to task no. 4: it is, in fact, designed for the initial training of advanced users, future managerial staff of the Ministry who follow a two-year, post-graduate training at ENGREF (the French Institute of Forestry, Agricultural and Environmental Engineering) before taking up their professional assignments.

Since these students have been recruited from various backgrounds, their existing GIS knowledge varies widely: some are already at an advanced level, others are novices in the domain.

In a traditional classroom environment, these different 'upstream' levels can only be accommodated by dividing students into distinct groups, where some follow an introductory course and others more advanced and in-depth ones (work with autonomous groups conducted on real cases).

Desynchronisation thus seems to be a procedure most suitable for the 'individualised' treatment of a trainee group, one that allows each student to start from his initial level and progress independently at his own speed within a system of pedagogical support and tutoring.

Limitations specific to ENGREF (multi-site institute) lead to a situation that the period when students are available for this skills-upgradation exercise (January to March) corresponds to the time when they are in Paris, whereas the GIS teachers are in Montpellier.

The desynchronisation is necessary therefore in both the temporal and spatial dimensions.

2.1 – Design:

The technical architecture that has been set up has been described above (two servers, of which one is the pedagogical environment server (Ceres Form@gri) and self-service computers equipped for practical-work exercises).

The open syllabus offered to the students aims to bring them up to a minimum final level in GIS (mastery over the concepts and basic methods, a grasp of the software architecture).

This syllabus corresponds to a classroom-training module of about one week and consists of five pedagogical stages or sequences:

- Introduction to GIS and software.
- Acquisition and updating of geographical databases.
- Georeferencing and projection systems.
- Spatial analysis operators.
- Cartographic plotting.

Each sequence consists of assembled activities:

- Online presentation of the course concepts (supported by complementary documentation).
- Practical hands-on work that supports the course (worksheets accessible online, software and data accessible on intranet servers).

Each sequence ends with two short quizzes, one on the course, the other on the practical work. This allows each student to assess himself and to ensure that he has acquired the main concepts aimed for.

2.2 Conduct:

The programme was conducted between January and March 2004.

The skills-upgradation module began with:

- A quiz for initial assessment that allowed the trainers to position each student within the training requirements (objectives aimed for – starting level).
- A half-day classroom session that presented to the students the organisation of the training, and operational and support modalities.

Students who were already sufficiently advanced took on the roles of immediate tutors for their fellow students by:

- Providing answers to queries from their classmates,
- Answering questions posted on the forums, answers that were later validated by the remote forum moderator/tutor.

In mid-programme, a half-day fac-to-face session was organised to take stock, confirm or adapt the activity goals, and to re-motivate the students.

At the end of the programme, a final quiz allowed each participant to assess his knowledge and to validate acquired skills.

2.3 – Evaluation:

This first attempt was subject to practical implementation difficulties (too tight a deadline for developing pedagogical tools, insufficient ‘habit’ of the trainers for E-learning tools).

Nevertheless, it proved promising at two levels:

- For the training of this specific audience. This skills-upgradation module will be improved and reconducted in future years because it allows each student to learn at his own speed, depending on his initial level of knowledge, personal limitations and the level to be finally reached.
- For the use of this mechanism at a larger scale with the staff of the services. The mastery of the interaction between trainee and trainer is of great importance in this type of mechanism and the management of the tutoring is therefore essential to its success.

Conclusions

This complex project, structured into interdependent tasks, is now entering its main stage. It will conclude end 2005 after the complete set of structured training content, the pedagogical tools and the educational sets developed will be tested and evaluated before finalisation.

The steps taken so far seem to confirm the preliminary hypotheses mentioned above (granularisation of the training contents so that trainers can adapt their training offers, adaptation of the contents to suit the skills of the different target audiences, adaptation of the educational sets to the learning limitations and conditions of each target audience).

For each target audience in each training programme, the training offer will be useful and meaningful only if it fulfils requirements and overcomes limitations, imparting independence and motivation to each trainee.

References

Bazile P., 2004, Training offers in Geographic Information: methodological references as a preliminary requisite in a quality-control approach, AGILE 2004 - 7th Conference on Geographic Information Science

Haeuw, F., Duveau-Patureau, V., Bocquet, F., Schaff, J.L., Roy-Picardi, D., 2001, COMPETICE, outil de pilotage par les competences des projets TICE dans l'enseignement superieur, MEN/DT/B3, at <http://www.competice.fr>

StrateGIS project : at <http://www.lst.se/strategis>

Appendix : References for 'Common GIS culture' training (outlines)

Defining the Elementary Content Units (summary)

1. GI and GIS:

1. What is GI:
Differentiating between an object's drawing and its location in a referenced system.
Understanding the concept of 'spatial'.
Understanding the duality of Geographical Information (semantic/graphical).
2. What is a GIS:
Differentiating between maps/basic maps and GIS, between accumulation of layers and GIS, between digitized mapping and spatial analysis.
3. GIS software applications:
Knowing some software applications and their main features.

2. Geographical data:

- Duality of Geographical Information (semantic/graphical) (cf. E.C.U. n°1).
- Concepts of vector/raster representation.
- The main geographical frames of reference: (differentiating between raster/vector, scale).
- Necessity of suitability of use between scale and the project, difference between scale and accuracy.
- Concepts of primary/derived data (*)
- Importance of meta-data:
Document origin, creation date, update date, accuracy, scale used.
Implications of not taking them into consideration.
- Data proprietorship: data exchange, usage agreements/rights.
- Major formats and their limitations.

3. Creating and updating geographical databases:

- Fundamental concepts of data structuring.

- Problems arising from importing data from diverse sources.
- Georeferencing concepts.

4. GIS methods and tools:

- Using databases: different links, organisation.
- Spatial-analysis fundamentals: attribute request/spatial request.
- General principles of cartography:
Subjectivity in a map, dangers of an uninformed interpretation, precautions.
- Illustration/cartographic representation:
Knowing the key items for page layout: scale, compass points, legend, author.
- Photo-interpretation: recognising some objects (*).

5. National and local context:

- Consistency between the Ministry's Information Systems.
Incorporation of Geographical Information (graphical & semantic data) in the national Master Plan.
- Geographical Information and the service's area of operation:
Consistency of the service's Information System regarding the territory,
Control tool/management tool,
Local partnerships and projects.

Implementation notes (for follow-up):

- Some topics should not be introduced except in in-depth programmes (whose duration is two days or longer) or during hands-on practical sessions. They have been indicated with a (*).
- Development of descriptive examples and illustrations which permit the integration of granules between themselves and impart to them an overall pedagogical consistency.
One can thus, using a well-chosen example, take up the following points:
 1. What is a GIS:
 - Objects + semantic information.
 - Stacking of layers
 - Recap: geographical space
 - Concept of zoom
 - Creating and updating data (if necessary, to be approached in detail: E.C.U. n° 3)
 - Concept of spatial analysis (if necessary, to be approached in detail: E.C.U. n° 4)
 - Concept of page layout:
Differentiating between maps/basic maps and GIS,
Differentiating between layer accumulation and GIS.
 2. Explaining the difference between digitized mapping and spatial analysis.