

INDIVIDUALIZED TRAINING PACKAGES; AN ITC CONTRIBUTION
FOR THE IMPROVEMENT OF PHOTOGRAMMETRIC OPERATOR AND
TECHNICIAN TRAINING SYSTEM

C. Paresi

J. de Lange

ITC, Enschede, The Netherlands

Commission VI, Working Group 8

ABSTRACT

Photogrammetric map production depends to a large extent on the professional level of those who are carrying the direct production work: the operators and/or technicians. The yearly demand for such well trained personnel is much too large to be covered by the few specialized institutes providing training at this level. Consequently most of the photogrammetric operators/ technicians are trained in mapping organisations in a far from systematic and optimal way. The purpose of this paper is to outline an alternative training system consisting of training packages prepared by specialised institutes like the ITC for use in mapping organisations and/or at educational institutes, and aiming at:

- improving the social-economic aspects of operator/technician training.
- matching the requirements of employment and background of the target population.
- enabling flexibility to meet the individual needs of trainees or employing establishments.
- making available the necessary learning material and equipment to support the local instructors whose means are often limited.

Although the system is particularly well adapted for operator/technician training it can be easily used for other levels of training.

1. INTRODUCTION

Maps are a basic requisite for economic development. Economic, industrial and natural resources development depend more and more on cartographic service to promote efficiency and economy. However, the status of world mapping is as such (in 1980, 13.3% of the world was mapped at 1:25,000, 42.2% at 1:50,000 and 1:100,000 and 80% at 1:250,000 [1]) that it will still take 20 years, especially in the developing countries, to map the world at 1:50,000 if the cartographic mapping continues at the same speed.

De Henseler [2] in analysing the reasons why mapping progress is made at such a slow speed concludes that the lack of well trained personnel at the right level was one of the most critical bottle necks for speeding up the mapping process, in particular in developing countries.

Brandenberger [3] and Bos [4] have made an attempt to quantify the needs of competent personnel needed at the different levels in mapping organisations. They have also clearly shown that education and

training facilities are insufficient, particularly in the fields of photogrammetry and cartography in developing countries.

Photogrammetric map production depends to a large extent on the professional level of those who are carrying out the direct production work: the operators and/or the technicians (1). The yearly demand for new well trained personnel at this level is much too large (around 2000 operators/technicians) to be covered by the few specialized international or regional institutes (2) (maximum training capacity in total: around 200 per year) providing training at this level. Consequently most of the photogrammetric operators/technicians are trained in mapping organisations in a far from systematic and optimal way.

2. A SOLUTION FOR ADEQUATE TRAINING OF PHOTOGRAMMETRIC OPERATORS

2.1. General:

In view of the urgent need for well-trained professionals at the various levels in photogrammetry, the ITC has developed plans to assist developing countries in setting up training courses at the lowest professional level at a national or institutional basis.

International or regional training at this level is considered not to be the most appropriate solution for the following reasons:

- . the number of persons per country to be trained at the operator level is usually large enough to make a national or institutional training programme feasible.
- . at national level, training programmes can better be geared to the national needs and circumstances. This is even more true for the in-service type of training where specific needs of the mapping organisations concerned can receive full attention.
- . in view of the large number of people to be trained, the cost for international or regional training is too high. At the lowest professional level, language problems may further prove to be a serious handicap for effective international or regional education.

Against this background, the ITC has recently developed an alternative system, for optimal training of photogrammetric operators/technicians, consisting of Individualized Training Packages (3).

- (1) "A technician in photogrammetry is a good experienced operator with leadership capacity and provided with some additional photogrammetric theory" [5]
- (2) Directorate of Overseas Surveys (DOS) at Tolworth, Swiss School for Photogrammetric Operators (SSPO) at St. Gallen, International Advanced Training Centre for Photogrammetric Operators (IPO) at Stuttgart, Regional Center for Training in Aerial Surveys at Ile Ife, School for Photogrammetry and Cartography at Bandung, International Institute for Aerial Survey and Earth Sciences at Enschede, etc.
- (3) Derived from an International Labour Office (ILO) approach to vocational training called: "Modules of Employable Skill" (M.E.S.) [7].

The purpose of this paper is to introduce this system and the methodology used to develop it. Another paper [6] will present an operational application of this system (see also para. 2.3.).

2.2. Individualized Training Packages:

2.2.1. Concept:

Individualized Training Packages are universally applicable training programmes developed by specialized institutes like the ITC (large experience in teaching, available staff specialized in photogrammetry and education, available backing up services and available funds to provide these means for a number of years to develop such training packages). They are meant to be purchased by individual mapping organisations and/or educational institutes, which (in particular in developing countries) do not have the opportunities to prepare such training packages, to satisfy their particular employment needs.

An Individualized Training Package for a given job has the following characteristics:

- it is comprehensive: it consists of all the learning packages needed for learning the specific skills required to perform the component tasks of a job. It makes available the necessary learning material, work material and equipment to support local supervisors whose means are often limited. It includes furthermore supervisor and trainee guides for efficient use of the package.
- it is flexible (see appendix 1): it is adaptable to the particular trainee and to the specific employment criteria in a particular organisation. This is made possible by the very flexible (modular) structure of the training package and the flexibility offered in the choice of working methods (procedures) and training material.
- it is in principle as much as possible learner-oriented but provision is made for the training of qualified supervisors. The learning material is for use by the trainee who is expected to learn from it by himself and at his own speed. It includes instructional texts books, assignments and self-checks. Short special training programmes are developed to enable future training supervisors to introduce the Individualized Training Packages in their organisations and to ensure the continuation of the training. For this they will learn: how to introduce the training in such a way that it fits optimally to their training needs; how to take care that their organisations environment is ready to implement the training; how to compile individual training packages; how to supervise the training process; how to collect, analyse and judge evaluation data and outcomes; and how to start new future training programmes.

Individualized Training Packages are particularly well adapted for operator/technician training but can easily be used for other levels of training. In particular a training package for operator/technician can be used for the preparation of the trainees for entering higher courses or as basic elements for higher education. Indeed, practical skill training required for an operator/technician to carry out his daily work is also partly necessary for the engineers and others who will have to supervise and check such work.

2.2.2. Methodology for the preparation and implementation of Individualized Training Packages:

As already mentioned Individualized Training Packages are to be developed (prepared) by specialized institutes like the ITC and to be implemented in mapping organisations and/or educational institutes (in particular in developing countries).

a) Preparation of an Individualized Training Package:

The task of a specialized institute like the ITC in the development phase of such a training package is to analyse systematically the occupational area selected, to define the necessary learning content to make the package universally applicable, and to prepare (produce) all necessary learning materials, aids and equipment to enable the trainees to learn the job. It is also its task to revise adequately the content, material and learning structure to adapt the package to specific needs, to the state of the art and to educational improvements. This is done in cooperation (regular contacts) with mapping organisations and/or other educational institutions. The development phase is described below in more detail.

Once a job (occupational area) has been selected (e.g.: Photogrammetric map making at operator level [6]) this job is analyzed to identify its components. This phase includes the determination of job standards and specifications from which one can establish training standards and specifications. Furthermore it also includes, through analysis of what is actually done, the identification of tasks, tasks elements, variable factors, and knowledge and skills required in each task element.

The identified tasks are then grouped to form Modular Units which are a logical and acceptable division of work showing a clear start and end of an activity not to be subdivided any further (e.g.: Relative orientation on analogue instruments [6]). Depending on the size of the occupational area, Modular Units may be in turn grouped in Fields of Work which are clearly defined branches of the job (e.g.: Graphical stereoplottling on analogue instruments [6]).

For each Modular Unit a learning package is prepared. A learning package consists of a series of Learning Elements. Learning Elements are self-contained instructional booklets (see appendix 2), each covering a specific learning objective (theory, information or activity). The amount of learning that each Learning Element covers is small, significant and precisely matched to the learning objectives. Each Learning Element starts with a learning objective, a list of material and equipment needed and a list of other Learning Elements related to it. The instructional pages contain short, concise texts and illustrations. Much attention is paid to practice the skills concerned. The Learning Element ends with a progress-check precisely matched to the learning objectives. The text is presented in such a way that translation into other languages can easily be done. The presentation of Learning Elements lends itself to easy reproduction and adaptation into other media (sound/slide, etc.).

The Learning Elements and/or the learning packages (Modular Units) can be combined in various ways to form individual training programmes geared to the actual training needs and specifications.

b) Implementation of an Individualized Training Package:

Once an Individualized Training Package is purchased by a particular organisation, the tasks and responsibilities are transferred from the specialized institute (development of the package, training of the supervisors) to that particular organisation (implementation) and especially to the therefor trained supervisor.

Implementation of an Individualized Training Package in a particular organisation will include the following phases:

1. precise definition of the organisation's manpower planning (how much trainees per year, full/part-time training, etc.) and employment criteria (procedures, methods, standards, materials, equipment used in the organisation).
2. preparation of the organisation's environment to implement the training (space, material and equipment).
3. compilation of the Individual Training Packages (see appendix 3)
 - . selection and preparation of trainees for the training programme
 - . trainee assessment (determination of background, aptitudes and abilities of the potential trainee) which will permit the trainee specifications (list of skills/standards possessed by the trainee) to be defined.
 - . definition of precise training specifications (specification of the skills/standards needed to fill the gap between the trainee specification and the Modular Units respectively Field of Work objectives) which permit to select the Learning Elements, training material and equipment needed for the particular trainee. At this stage specific training materials, methods and standards of the particular organisation can be included in the Package to replace the originally prepared ones. Also, in special cases, it might be needed to make completely new Learning Elements to fulfil the specific needs of a particular organisation (this is done by the specially therefore trained supervisor and in cooperation with the specialised institute).
4. supervision of the training: implementation of the start of individual training programmes, giving assistance in case of difficulties, giving instruction whenever needed and supervision of the assessment of the skills to be learned.
5. evaluation of the training package, analysis of evaluation data and implementation of evaluation outcomes, this last point in cooperation with the specialized institute which developed the training package.

2.3. The ITC Training Package for Photogrammetric Operators (TPPO) [6]

In 1983 the ITC started the production of an individualized, universally adaptable Training Package for Photogrammetric Operators (TPPO) that can be purchased, from 1985 on, by individual mapping organisations and/or educational institutes for internal needs and based on the system here above described.

The objectives of the TPPO are to train photogrammetric operators in such a way that after training they should be able to carry out the basic tasks concerned with the production of graphical-photographical-digital maps in mapping organisations.

The package is meant primarily for training in mapping organisations, but it is set up as such that it can be used in educational institutes for training photogrammetric operators and as part of higher educational programmes in photogrammetry. The package is primarily meant for training skills but includes the required basic knowledge for those skills. It is composed of Learning Elements (theory, information and activities) which incorporate regular self-checks and different sets of training materials. While the training package has been prepared to be used with the therefore specially designed computer supported Stereo Plotting Simulator (SPS), it can also be used with normal stereoplottling instruments.

Although the training package has been designed to be learner-oriented its implementation in individual organisations necessitates the presence of a training supervisor with sufficient professional educational and practical experience. Short special training programmes have therefore been developed at the ITC to train future training supervisors, to introduce the training package in their organisation and to ensure the continuation of the training.

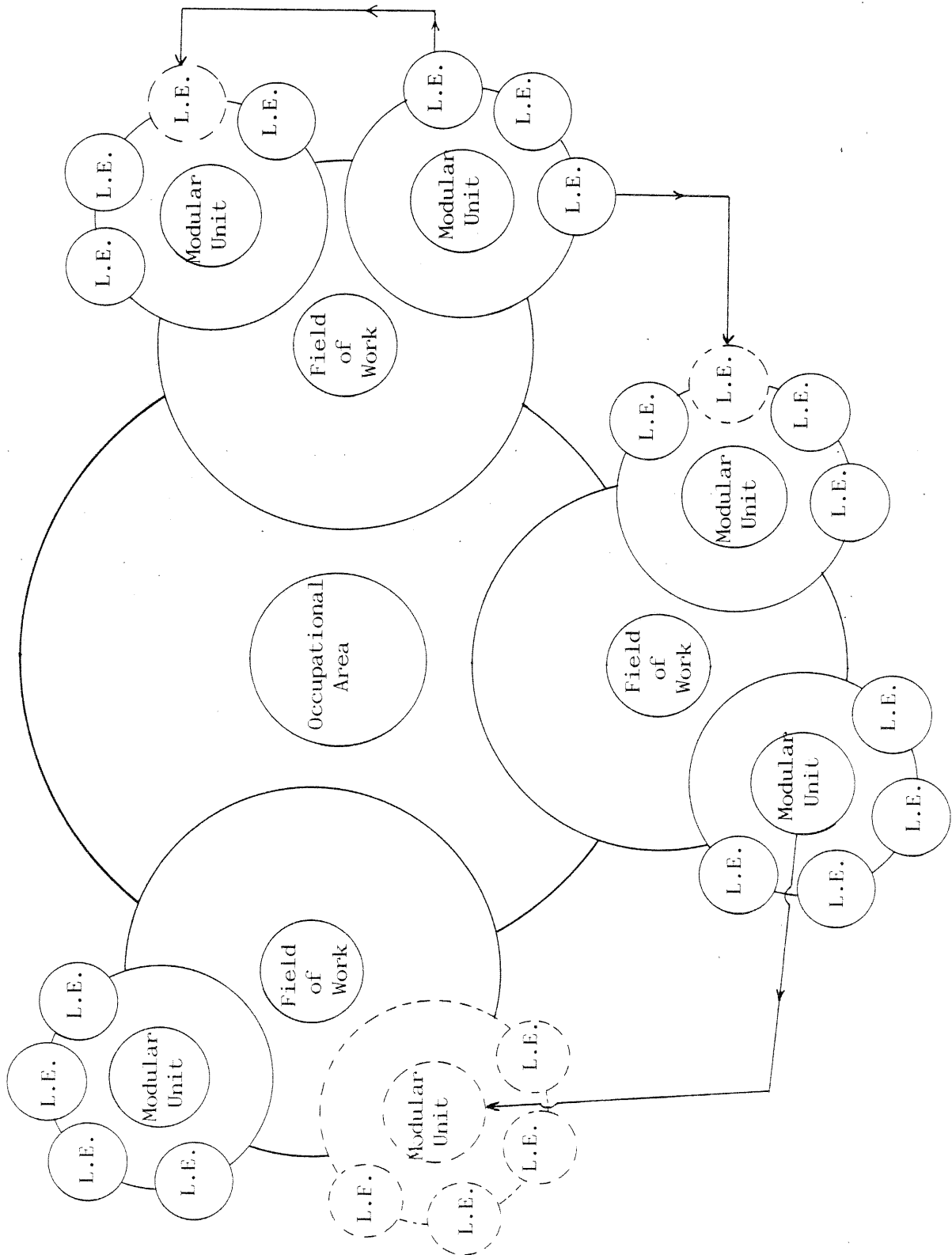
3. CONCLUSION

Universally adaptable Individualized Training Packages seem to offer an adequate means to fulfil the needs for training well qualified personnel at the right level in surveying and mapping in general, and at operator/technician level in photogrammetry in particular. As such they will certainly contribute to the improvement of the mapping progress, in particular in developing countries.


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OVERALL STRUCTURE OF AN INDIVIDUALISED TRAINING PACKAGE



LEARNING ELEMENT CONTENT

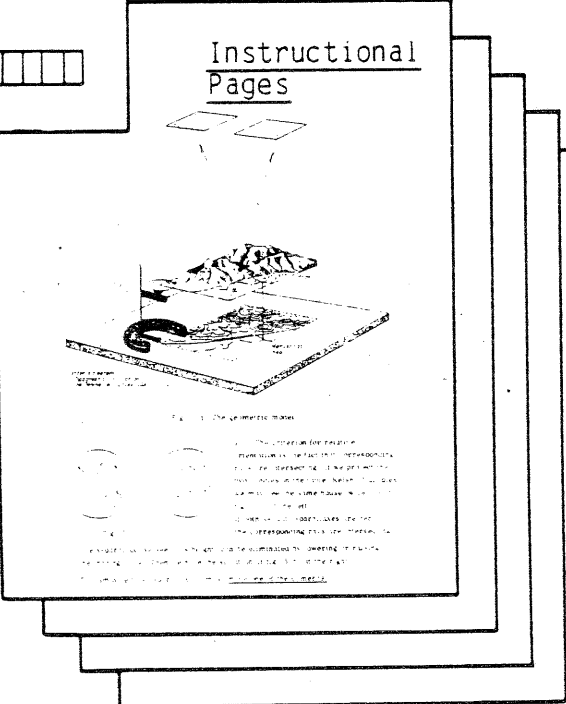
	<p>LEARNING ELEMENT</p>
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Objectives

What the trainee is expected to do after having completed the learning element:

Equipment, Materials and Aids needed.

Related Learning Elements



Assignments

To practice the skills learnt in the learning element.

Progress Check

That precisely matches the objectives, of the learning element.

PROCEDURE FOR COMPILING AN INDIVIDUALISED LEARNING PACKAGE FOR A MODULAR UNIT

Appendix 3

