# Learning Pyramids

**Bela MARKUS, Hungary**

**Key words**: Curricula Models, Capacity Building, Education and Training.

## SUMMARY

A fundamental transformation could be observed in the world of education and traning. Information and Communication Technologies (ICT) are having a deep effect on learning and teaching. Internet based eLearning is eroding traditional geographical boundaries resulting in greater competition and opportunity. Surveying society needs education and training programmes that are flexible, tailor made and cost effective. In the rapidly-changing world, mapping agencies and land administration must offer all end-users wide variety of spatial data and information services. Employees should have greater opportunities for access to knowledge because of the weakness of education in the management, legal, economic, human and ethical aspects of land administration; general lack of user oriented approach to education; lack of continuity in education from universities to professions and appropriate linkage between the two. In Hungary the land registry and mapping sector has such important tasks as e.g. providing digital spatial infrastructure for the information society, recording tasks related to the agrarian assistance and the redistribution of land property together with its preparations. Geoinformation technology will soon spread in land offices. Well prepared specialists are required for these tasks.

The aim of this paper is initiation of a panel discussion at the Workshop on *Virtual Academy and the Surveying/Geoinformatics Community*. The key issues are demonstrated by different pyramids. The first part is dealing with a knowledge pyramid. In the second part the eLearning pyramid is introduced. Our strategy in professional development is based on the staff-pyramid. Some results of the educational metadata investigations will be presented in also the paper. The last part of the paper is dealing with the Bologna Pyramid, the curricula development efforts of the College of Geoinformatics, University of West Hungary (GEO). The curriculum should be proactive taking into account both the Bologna Process and the new needs of the society.

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## 1. INTRODUCTION

Due to advances in digitisation, processing speed, storage and communications, we are living in a networking era. Education will have a crucial role in developing these capabilities. New job opportunities will be created in the processing, organizing, packaging and disseminating of spatial information. The networked world is changing the way we create products and provide services. All around us we find new tailored products, targeted marketing and customisation. Consumer demand for more choice, higher quality, lower cost, better service and convenient access is a dominant force affecting all industries, including professional education (Oblinger – Verville, 1999).

The move towards the information society is irreversible, and affects all aspects of society and interrelations between economic partners. An economy based on the creation, dissemination and exploitation of knowledge will be one of the dominant features of the 21st century, and will play a fundamental role in generating a recovery in growth and an increase in employment. Fuller use of the potential offered by information and communication technologies can:

- create new service markets;
- facilitate provision of services by the private rather than the public sector, including a new partnership between the private and public sector, e.g. for training;
- speed-up administrative decision-making procedures.

## 2. KNOWLEDGE PYRAMID

According to Russell Ackoff, the content of the human mind can be classified into five categories:

1. Data: facts or figures;
2. Information: data that are useful; answers to "who", "what", "where", and "when";
3. Knowledge: application of information; answers "how";
4. Understanding: appreciation of "why";
5. Wisdom: evaluated understanding.

The DIKW hierarchy can have many dimensions. One dimension of Ackoff's hierarchy is temporal. He says that while information *ages rapidly*, knowledge has a *longer life-span* and only understanding has an *aura of permanence*. It is wisdom that he considers to be *permanent*.

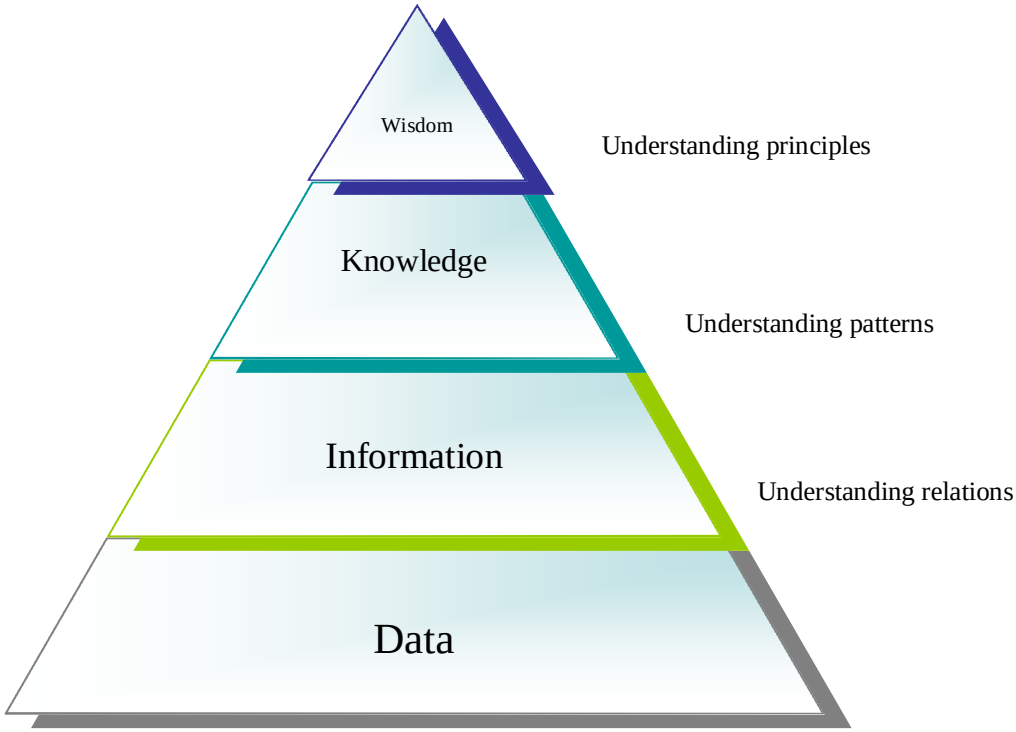


**Fig. 1.** Knowledge pyramid (based on Ackoff's hierarchy)

Likewise the other organisational assets data, information and knowledge should also be managed. The definition of Knowledge Management (KM) by Oracle Magazine (1998) is the following: "Knowledge Management promotes an integrated approach to identifying, capturing, retrieving, sharing, and evaluating an enterprises information assets. These information assets may include databases, documents, policies, procedures, as well as the un-captured tacit expertise and experience stored in individual's heads." Knowledge management involves data mining and some method of operation to deliver information to users.

In the dynamically changing world of business, the competitiveness of companies (and/or universities) depends heavily on the possibility to find, for a given problem, the right knowledge in the right moment. By using a Knowledge Management System (KMS), organisations increase returns, save time and money, are more adaptable, and have a far better understanding of partners, processes, customers, competitors and their business. To benefit from every customer or partner interaction, corporations must give employees opportunities to record what was learned. Efficient knowledge management needs not only document knowledge but must provide tools for collaboration to all contributors to the knowledge pool. Then, other employees must have access to the data and the means to understand it in context. Knowledge management helps an organisation to gain insight and understanding from its own experiences. When employees use this KMS, best practices are

stored throughout the organization, and each employee accessing the system has similar power to the best employee (ArsDigita, 2001).

Tabberer (2003) emphasises the need to make organisations not just 'data rich' but 'information rich' and 'knowledge rich' as well. An organisation might be quite good at organising and using data (e.g. understanding the spread of performance and being able to analyse which departments tend to do worst); it may even be quite good at managing information (e.g. one part of the organisation knows what others are doing and planning). That does not mean it is good at managing knowledge (i.e. making what people have learned about what works available in a form which others can readily use). Data may help organisations benchmark their performance externally and internally. It may help them ask questions and recognize surface problems. However, without managing information, they will not know exactly who out in the wider world is doing better, and why. Finally, without managing knowledge, they will not be able to learn effectively and put what they learn into practice.

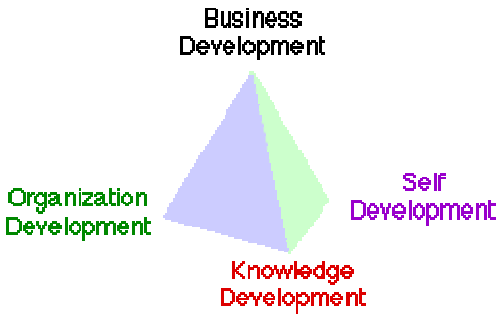


**Fig. 2**. Business development pyramid (Source: http://www.mithya.com/home.html)

## 3. eLEARNING PYRAMID

Taylor (1999) has realized that distance education development reached a new phase. In his schema, the first generation of distance education, the correspondence model, was based solely on print technology; the second, the multimedia model, was based on print, audio and video technologies; the third, the tele-learning model, involved the application of telecommunications technologies to provide opportunities for synchronous communication; and the fourth, the flexible learning model, is based on on-line delivery via the Internet. The fifth generation is beginning to emerge. It will use automated response systems that scan the text of incoming e-mail and respond intelligently without human intervention, thereby decreasing the cost of online tuition and increasing access to learning opportunities on a global scale. Taylor calls this the "intelligent flexible learning model" that will enable a quantum leap in economies of scale and cost effectiveness.

Learning technology is rapidly changing. In previous years we focused on Content Management (CM): content creation, electronic publication, Internet-based communication and student support, taking into account the special pedagogy of distance education. However, we realized the need to move from CM to KM also in eLearning.

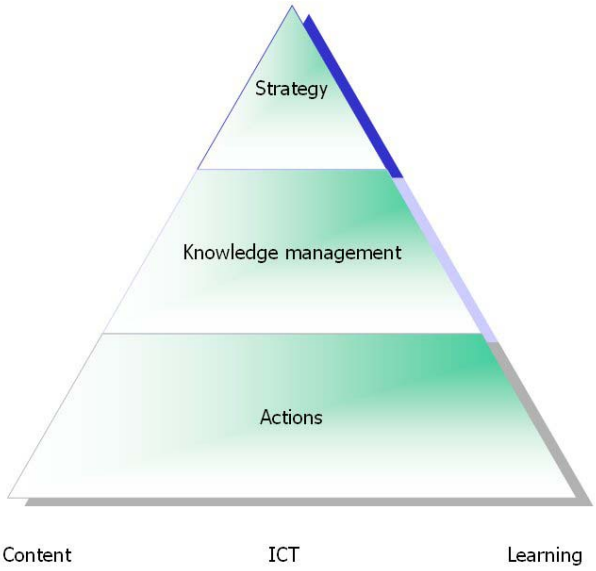


**Fig. 3.** eLearning pyramid

In KM environment the structure of the learning materials should be re-engineered. In this new structure the basic elements called learning objects. Learning objects can be described as the competencies to be achieved, skill and knowledge outcomes, lesson plans, assessment items and other learning resources. They can exist in a variety of forms such as presentations, articles, quizzes, people, Web pages, images, maps, samples etc. They can be stored in databases and used, reused, aggregated as desired or re-purposed by learners, teachers and course designers for their own particular purposes, thus moving us towards a "learning on-demand" environment. And they can be accommodated within various delivery models such as print, CD-ROM or Web-based. The use of common standards will make these learning objects databases accessible to any organisation that shares the same standards. This development is already starting to change the way we think about the notions of curriculum and courses.

For strategies to promote a learning-for-all culture, direct measures are needed to motivate potential learners and increase overall participation levels by making learning more attractive in terms of active citizenship, personal performance and employability. Schools, universities and training centres are urged to become local knowledge acquisition centres which are versatile and accessible to everyone.

The urgent task for educational institutions is to reorganise resources for professional development services. In extending existing education and training programmes, the main objectives should be:

- to develop still further the corporate dimension of education;
- to improve the quality of training and foster innovation in education by increasing exchanges of experience and information on good practice;
- to establish an area of training by obtaining recognition of its qualification;

- to promote the virtual mobility, which was made possible by new communication technologies;
- to develop common databases and other sources of knowledge on skills needs;
- to conduct comparative research on methodologies used and policies implemented;
- to improve the interoperability of systems of distance learning and increase the level of standardisation.

Educational institutions worldwide spend large amounts of money each year developing, adapting or acquiring learning resources and courses. The development of electronic learning resources is particularly expensive and often produces course materials that are platform or operating system dependent. This situation has lead to discussion of the creation of standardized learning objects that can operate across hardware platforms and software systems.

Metadata will be fundamental in implementing similar systems. Whilst learning units form the building blocks of a networked and inter-connected environment, metadata is required to bind the units together and allow them to interoperate. Metadata is required to describe what learning units look like, how to build a learning route from them, what if any refinements or value adding operations have been carried out on a unit, and in a networked environment what services a tutor/learner can request from a server and what parameters the teacher/student should send to the server to request the service. Adopting a standards-based approach makes it easier to change system components in future. IMS (IMS Global Consortium, previously known as Instructional Management Systems) IEEE and Dublin Core provide a range of specifications that yield a standardised data format, allowing different systems from different vendors to work together. For seamless searching to work, the world has to agree on the specification of educational metadata (Markus, 2000).

## 4. STAFF PYRAMID

The efficient handling, updating and maintenance of the spatial data infrastructure needs highly qualified, properly trained staff. Learning and working are more and more similar. The concept of the ‘learning organization’, including ‘lifelong learning’ for staff, is now recognized as a key element in corporate strategies. This will reinforce consistency, common identity, shared corporate culture, common actions, clear responsibilities, coordination and dissemination of good practice.

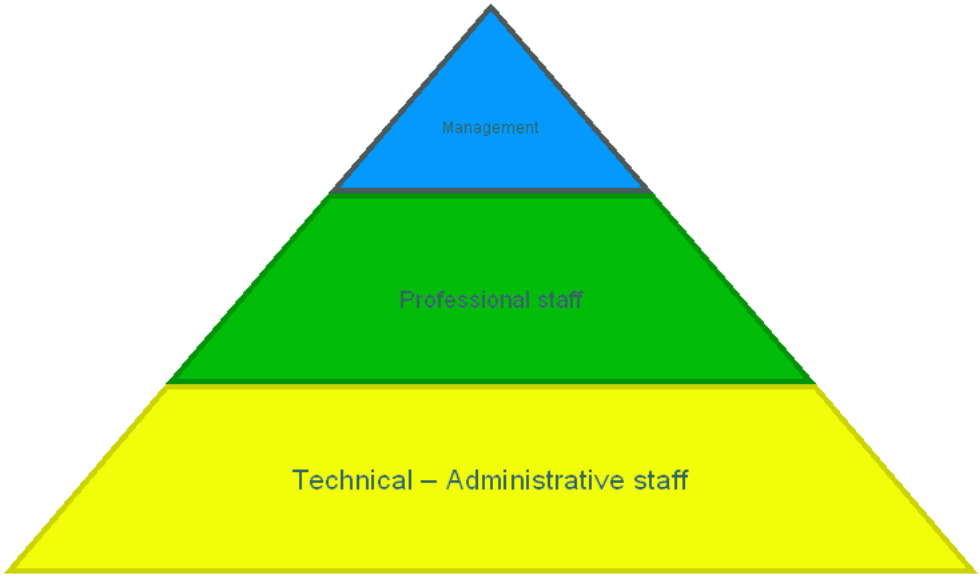


**Fig. 4.** Staff pyramid

Traditional universities usually develop a firm educational foundation for professional BSc/MSc level staff. Now we should seek to build towards a more flexible programme of short cycle staff development activities. This differs from the previous in that study will not be part of an overall academic programme, it can thus be more flexible and will be targeted in different ways towards differing levels of ability and differing staff requirements. New programmes should be delivered for the higher management and a set of programmes for all levels in Land Administration focusing on organisational issues, on skills and on matters pertinent to new challenges.

Nowadays increasing numbers of companies are using Internet-based technologies to help them meet their training needs. In the workplace, ICT based open and flexible, distance learning (eLearning) provides flexibility in terms of place, time, pace and style, enabling just-in-time training where and when required; integration into the workplace for greater convenience and relevancy; and possibilities for collaborative team working. Encouraging staff to take responsibility for their own learning has motivational benefits. eLearning materials for business training can be quickly updated and adapted to reflect changes in legislation, procedures or market trends.

Traditional educational systems use the “campus-bound” the concept, but there is an emerging trend to the “campus-based” concept. The former assumes that the quality of a programme depends entirely on the text books, presentations, faculty members, students etc. are on-campus. But the latter allows that some of the resources and some of the learning are off-campus.

A distributed learning environment is a learner-centred approach to distance education, which integrates a number of technologies to enable activities and interaction between students and tutors. Our model is based on amalgamating appropriate technologies with aspects of local

learning centre-based workshops and co-operative Internet-based distance education. This approach gives tutors the flexibility to meet the needs of diverse student populations, while providing both high quality and cost-effective learning.

The technical side was emphasized above. However, the distributed learning environment is a social system too, consisting of the continuous development of knowledge, skills and competences in which subsystems can occur, distributed in time and place, and in which information and communication technology ensures collaboration. The ability of students to connect with experts around the country, as well as their group members, also opens new opportunities for learning and professional development. Students and tutors find these opportunities motivating. Distributed instruction, the explosive expansion of networks, and the trend to move bits instead of people and products will continue to erode the domination of traditional educational institutions.

The teaching is not enough, it is the active (or pro*active*) learning which is essential. Placing learners and learning at the centre of education and training methods and processes is by no means a new idea, but in practice, the established framing of pedagogic practices in most formal contexts has privileged teaching rather than learning. Teachers traditionally convey the knowledge they possess to learners, who subsequently must show what they have learned. In this approach, teaching is largely proactive, whereas learning is largely reactive. The purpose of the process is essentially to convey content, and the core problem is to find the most effective teaching methods for doing so. Learners certainly participate in this process, but the extent of self-direction and co-determination they may bring to it is inevitably circumscribed.

## 5. BOLOGNA PYRAMID

The Bologna process is a challenge to create an open European higher education area, a frame that is expected to facilitate closer cooperation between higher education institutions, make easy student and staff mobility. The basic aims of the Bologna Declaration may be summarised in three key words: mobility, employability, and competitiveness. In more detail, the objectives are the following (Teodosiu, 2003):

- adoption of a system of easily readable and comparable degrees;
- adoption of a system essentially based on two main cycles, undergraduate (bachelor - BSc) and graduate (master – MSc);
- establishment of a system of credits – such as in the European Credit Transfer System (ECTS) - as a proper means to promoting the most widespread student mobility;
- promotion of mobility by overcoming obstacles to the effective exercise of free movement;
- promotion of European co-operation in quality assurance with a view to developing comparable criteria and methodologies; and
- promotion of the necessary European dimensions in higher education.

The changes are now reaching Hungarian universities and the dimensions set in the process are being adapted or taken in consideration also by the University of West Hungary. In view of the above, several actions were started:

- 2002 - the introduction of a credit accumulation system compatible with the ECTS, in order to enhance the flexibility of national higher education system and to promote mobility;
- 2003 - the implementation of a common national frame of reference for qualifications, serving as a reference point (in BSc studies), but also allowing for differences (in MSc courses); and
- 2004 - the adaption of a European dimension in quality assurance, evaluation and accreditation, by means of compatible quality management systems.

A new Act on Higher Education is under preparation, planned to be issued soon. The Ministry of Education expects the introduction of the three-cycle, linear BSc-MSc-PhD system in 2006.

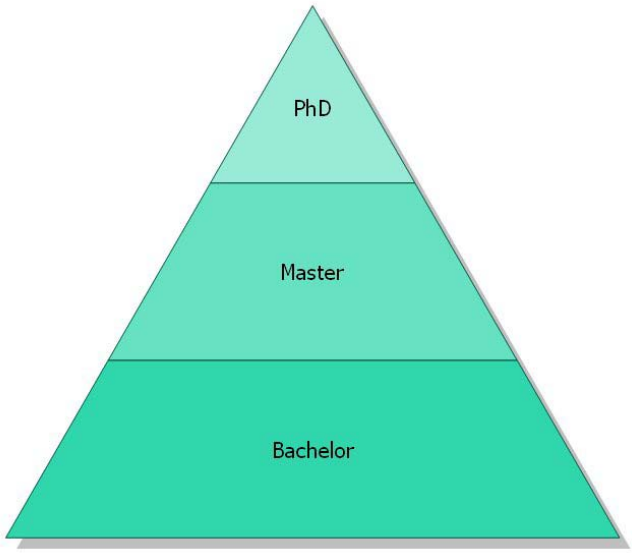


**Fig 5.** The levels of the Bologna pyramid are BSc, MSc and PhD.

The Bologna process will highly change the educational systems of European countries and will have a great impact on the surveying courses world-wide. FIG Commission 2 should take into account these changes and build into the working programme the comparison of curriculas and evaluation of experiences.

## 6. CONCLUSIONS

The job market in general will become much more dynamic, complex and heterogeneous. Our experiences greatly improve the knowledge transfer between academic institutions and industry has vital importance. FIG Commission 2 is a good forum for increasing collaboration between professional institutions and the sharing of learning resources.

Information and communication technologies as driving forces in the network revolution will have a dramatic impact on our daily life, working routine and education. Information technology will become essential everywhere. We must transform all traditional institutions of learning in order to prepare students for their future, not for our past. In addition to basic professional skills, every learner should master communication, collaboration, and creative problem solving. These are the very important skills and attitudes needed to be a lifelong learner.

## REFERENCES


ArsDigita, 2001: Knowledge Management, http://www.arsdigita.com

Ackoff, R. L., 1989: "From Data to Wisdom", Journal of Applied Systems Analysis, Vol. 16, p 3-9.

Bellinger, G. et.al., 2004: Data, Information, Knowledge, and Wisdom, http://www.systems-thinking.org/dikw/dikw.htm

Kaipa, P. et.al., 1998: Application of Pyramid Building in Organizations: Aligning Strategy, Processes, and People in Organizations, http://www.mithya.com/home.html

Márkus B., 2000: Educational metadata, Proceedings of FIG Working Week, Prague.

Márkus B., 2002a: (Global) spatial knowledge management, GSDI6 Conference, Budapest.

Márkus B., 2002b: Strategy for professional development and academic responses - a Hungarian case study, “Land Registration and Spatial Planning in Transition Countries: Opportunities for the European Union” workshop, Wageningen.

Márkus B., 2004: Curricula development in Bologna Process, FIG Working Week, Athens.

Oblinger, D. G. - Verville, A-L., 1999: Information Technology as a Change Agent, Educom Review, Vol. 34, No 1.

Tabberer, R., 2003: Knowledge and Innovation, ttp://www.standards.dfes.gov.uk/innovation-unit/pdf/knowledge_and_innovation.pdf

Taylor, J.C., 1999: The death of distance: The birth of the global higher education economy, e-Journal of Instructional Science and Technology (e-JIST), 3, 1, 6-11.

Teodosiu F.(2003): An Introduction to the Bologna Process, http://www.cep.org.hu/

## BIOGRAPHICAL NOTES

Bela Markus is a land surveyor, M.Sc., Ph.D., professor of Geoinformatics, and director of the College of Geoinformatics, University of West Hungary. He has 30 years teaching experience in surveying, 15 years in teaching GIS and 10 years in development and organization of open, distance learning professional courses for land administration.

Prof. Markus has over sixty published papers on various aspects of using GIS. He is actively involved in many national and international academic programmes, is chairman of the Hungarian UNIGIS Course Board, chairman of the National Committee of Association of Hungarian Surveyors and Cartographers, chairman of the Agricultural Experts Committee Surveying Session at the Ministry of Agriculture. He is chairing FIG WG2.4 (Knowledge Transfer in SIM) and the Hungarian Scientific Committee of COST G9 "Modelling Real Property Transactions".

Prof. Markus is Council member of Association of GI Laboratories in Europe (AGILE) and also the Executive Committee of EUROPACE (Leuven, Belgium). He is chair elect of FIG Commission 2 and member of Board of Directors of FIG Foundation.

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