# Common, international and academic education in logistics

**B. Illés†, E. Glistau‡ & N. Coello Machado***

University Miskolc, Miscolc, Hungary†
Otto-von-Guericke-University Magdeburg, Magdeburg, Germany‡
Universidad Central Marta Abreu de Las Villas, Santa Clara, Cuba*

ABSTRACT: Academic education should prepare students for their profession in an effective and efficient manner. The most important individual factors for success in the profession as a logistician are: sense of responsibility, customer-orientation, goal-orientation, self-motivation, analytical thinking, problem-solving competence, social competence, creativity, ability to work in a team, good manners, ability to impose the will and persistence, flexibility, decision competence, integrity, self-reflection, ecological thinking, mobility, international skills, learning abilities and management skills. Academic courses in logistics are no longer conceivable without modern teaching methods aided by modern I&C technologies. In this paper, some highlights of the educational programme at Otto-von-Guericke-University Magdeburg, Germany, are presented and discussed. These are management games, Web-based contents and tasks, laboratories with radio frequency identification (RFID) and virtual technologies. These teaching forms are also the result of a long international cooperation.

## INTRODUCTION

The 21st Century has been dubbed the era of information and media technologies. As one important result of the widespread use of personal computers and the systematic extension of network computer architectures, the importance of acquiring, processing and disseminating information and knowledge has decisively increased. Therefore, following on from that logistics is no longer conceivable today without modern I&C technologies. This also applies to teaching methods.

In the following, some highlights of the educational programme of logistics are presented:

- The laboratory for analysis of logistical processes and logistics planning with VR technologies.
- The laboratory for order picking and order fulfilment (warehouse).
- Management games and the Fraunhofer laboratory LogMotionLab.

The difficulty is not to teach the content of a method, but rather it is the challenge to teach the understanding of a method in the context of all other activities. Knowledge about methods was transferred only in a theoretical manner in past. However, it is not enough to know what should be better, the logisticians have to change it by their own. That is the reason why the academic education in Magdeburg also uses different kinds of practical training and games to enable students to generate practical experience and competence.

## LABORATORY FOR ANALYSIS OF LOGISTICS PROCESSES AND DATABASE OF LOGISTICS METHODS

This computer laboratory has twenty places with one laptop per user. Practical training is provided in process analysis, logistics planning, information logistics with SAP®, modelling, simulation of logistics processes and systems and other lessons and trainings.

Methods in logistics are used all over the world. Therefore, they should also be accessible from anywhere [1]. A multilingual and Web-based database called *mlog* has been developed over the last few years. The method database is a prototype to evaluate the progress and state of research of methodical knowledge in logistics. Its two advantages are: first, is the capacity to be able to validate and verify ideas in method research; and second, to use a new perspective on methodical knowledge to improve research. The core of the mlog method database consists of several widely integrated modules (see Figure 1). The hard-core module is the presentation module for methods. Therewith, it is possible to show the method content as a Web page on the Internet or a Web page for printing. It also allows PDF documents to be created for on-line and offline reading.

Starting from this point, several search mechanisms have been implemented. These include a dynamic multi-language index of methods, a keyword search, a glossary and a branch-related index for the definition of the methods fields of application or branches of usage.


Figure 1: Mlog - a method data base for logistics (www.ilm.ovgu.de/mlog).

An internal messaging system with two main tasks has been implemented. A management module to support the administration tasks of this complex database-driven on-line application has also been developed. Tasks supported by this tool of the actual prototype include the creation and change of content for different kinds of users, such as:

- method content such as descriptions, references, graphics;
- literature references e.g. books, scripts and Web sites (URLs);
- user entries including username, password, statistical data;
- supporting information such as glossary and FAQ; and
- an index as a search tool.

The newest development includes an on-line calculation module. This provides calculation support for a numerical calculation and dimensioning methods in logistics engineering. For future development, the following three steps are to be carried out:

- completion of the development of the on-line calculation tool;
- introduction of method interaction abilities; and
- integration of problem and learning arrangements.

PROBLEM-SOLVING COMPETENCE BY USING METHODS OF QUALITY MANAGEMENT IN LOGISTICS

Quality Management (QM) methods are a major field in logistics. Everyone knows that failures can happen anywhere and that there are many options for improving processes. The task is to use the knowledge of quality management to prevent failures and to solve problems, both effectively and efficiently. This task is not an easy one, especially in logistics networks, where a failure can have many causes. A cooperative project between universities in Santa Clara, Cuba (Prof. Norge I. Coello Machado) and Miskolc, Hungary (Prof. Béla Illés) led to a teaching book being written, which deals with this topic. It was published in German and Hungarian. The Spanish and the English versions will be published in 2012:

Table 1: Common teaching books for teach-yourself studies in Hungarian and German.

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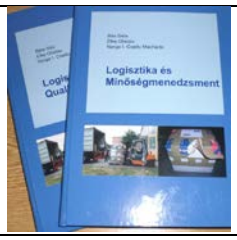
|---|---|
|   | Illés, B.; Glistau, E.; Coello Machado, N.I.: Logistik und Qualitätsmanagement. Teaching book. 1. Edition Miskolc (Hungary) 2007. 195 pages. ISBN: 978-963-87738-1-4 (German)<br><br>Illés, B.; Glistau, E.; Coello Machado, N.I.: Logistika és Minöségmenedzsment. Teaching book. 1. Edition Miskolc (Hungary) 2007. 195 pages. ISBN: 978-963-87738-0-7 (Hungarian) |

Logistics process analysis starts with logistics quality. Logistics quality can be defined as the extent to which a logistics process fulfils the requirements of the customers in the sense of EN ISO 9000:2005 [2]. Customer satisfaction is the most important aspect when discussing quality issues. Customer satisfaction is defined (in Ref. [2]) as customer perception of

the degree to which the customer requirements have been fulfilled. Characteristics are the capacity to deliver, the time needed for delivery and punctuality. To assure the quality of logistics processes, it is necessary to deal with failures and defects. Therefore, standard processes need to be developed to realise that in a systematic and holistic way.

The use of well-known QM-methods makes it possible to recognise failures and their causes in order to analyse logistics processes and systems (Figure 2).

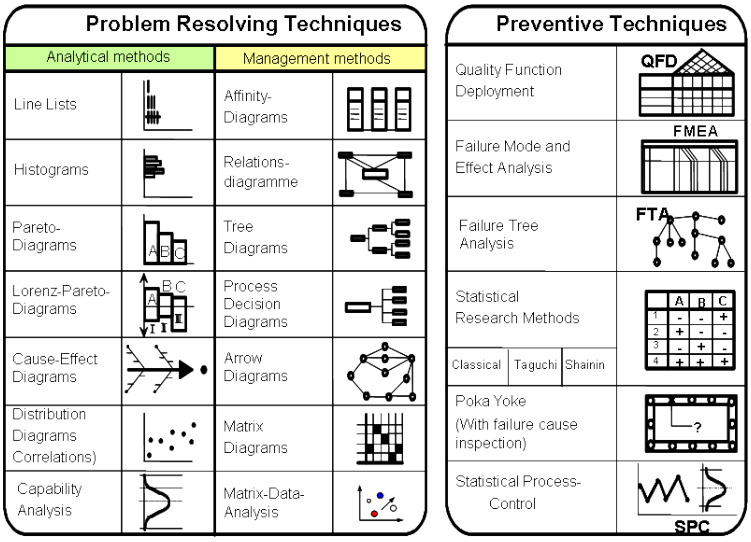



Figure 2: Overview of some important quality management methods [3].

This is a good way to see the causes in a timely and effective manner. After that, the next step is to eliminate the causes.

In the computer laboratory of Otto-von-Guericke-University, all these methods are applied in practical training. Therefore, different standard software is used: Microsoft Excel, Microsoft Visio and SPSS. The main idea is to gain one's own experience to practise problem-solving processes by using these methods and to hold practical discussions about them. After completing the training, the students should have created their own tool-set to solve problems in practice.

The practical education is provided as follows: every student has to download four databases at the beginning of practical training: 1) theoretical background; 2) task; 3) solved example as a reference solution; and 4) own data and space to come up with one's own solution of the problem. In this way, she/he creates and improves her/his own knowledge base. The tutor gives a short introduction and motivation of about ten minutes. A short discussion shows the way to solve the problem by using a reference solution. After that, every student has to solve the task on their own. This can be done in the laboratory with the possibility of being coached by the tutor or it can be self organised at home. The focus of the training is to build one's own competence in practical problem-solving. The solutions of each task have to be sent by e-mail to the tutor. At the following practical training class, collective feedback is given to all students with a short verbal reflection on problems, difficulties, misunderstandings, hints and some new ideas to improve or modify the methods and the problem solving method as a whole.

BICYCLE FACTORY - STUDENT IN THE ROLE OF A CONTROLLER

It is not very exciting to teach indicators. That is why it is useful to do so in a specific manner. Therefore, a computer game is used, in which the student takes on the role of the controller of a factory that produces bicycles (Figure 3).

The story behind the game is that that the boss is awaiting for a new controller's (student) brief report. She/he is interested in how the new controller will interpret the logistics indicators. The controller has to evaluate the current situation. Therefore, indicators are necessary; hence, knowledge is required on the indicators that exist and how to calculate them and which data are required [5-7]. The data are stored in the same database as they would be in reality. Some data are missing and the student has to assume this. The student also obtains some information from a video, other information from reports, and further information drawn from collected data.

The student's task is to:

- understand and accept the task and the role of the controller;
- obtain an overview about the company and about its individual departments;
- make a self study about indicators;
- find or to assume the data which are necessary;

- calculate the indicators in the correct manner [VDI 4400];
- interpret the indicators (with colours like traffic lights: green = o.k.; yellow = attention; red = big problem, alarm);
- evaluate the current situation as a whole and in detail;
- offer suggestions to improve the processes.

The results are Excel spreadsheets with indicators and individual comments.


Figure 3: Bicycle factory (available in German and English).

LOGISTICS PLANNING WITH VR TECHNOLOGIES

Another self-study activity is to create a planning concept for a distribution centre. The students download the task and related data. They receive coaching about the task from tutors. The tutors are students who are close to finishing their studies. For the task, participants are divided into two-person teams.

At first, each team has to do the theoretical work with many calculations. It starts with the goals and the restrictions of the planning task, the description of the various functions and chains of material and information flow, the forecast of the future development and the calculation of process times of the material flow. Both students reach the same results in this step.

The second part is an individual design part. The student has to create a new and individual solution by using VR planning tools. This is a fast way to do it and it provides fast feedback to the student about his or her work. A useful, intelligent and very *nice* solution will make her/him proud of her/his own work and will provide a very good motivation. Important results are the model, the kind and amount of technical equipment and the invest costs of the whole. TaraVRbuilder is a software tool for 3D configuration (see Figure 4) and time-based simulation of conveying, material flow and storage/warehouse equipment using virtual reality technology. The programme is used to visualise and analyse plants. Possible applications exist in the fields of sales support, planning, engineering and documentation.

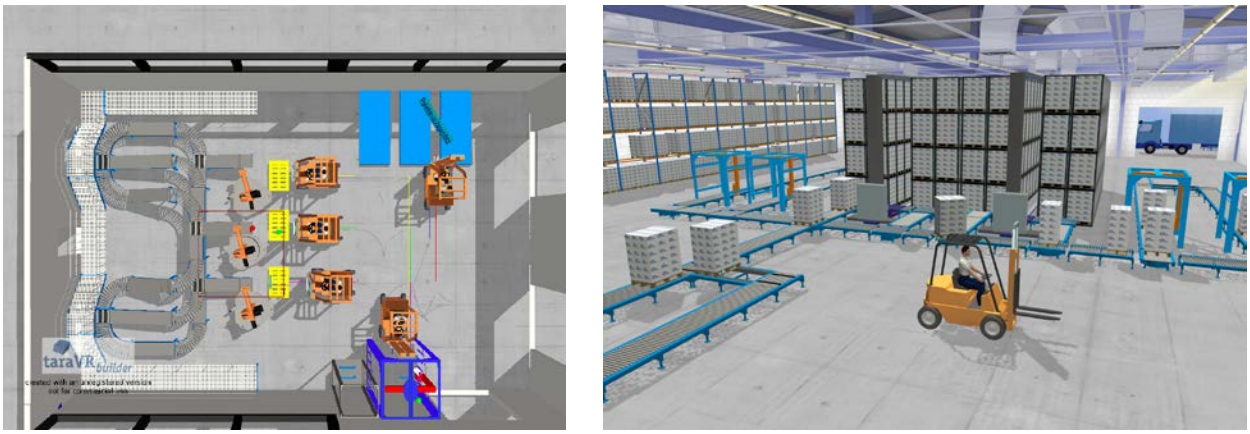



Figure 4: Example of a student solution and a demo by using the VR planning tool taraVRBuilder [11].

The third part is the evaluation of each team's design solution. The students have to define their own criteria, undertake a cost benefit analysis and give a projection which of the two solutions will be the best. This part is a self-feedback of their own work. The students find that this third part is the most difficult, because every student likes their own solution more than the other solutions and it is not easy to accept a better one and to learn how to do it better next time.

LABORATORY FOR ORDER PICKING AND ORDER FULFILMENT (WAREHOUSE)

Ten students and one tutor can make a realistic role-play in a distribution centre. The core roles of the laboratory are picking processes and warehousing (see Figure 5). There are five pharmaceutical products available in the warehouse.


Figure 5: Students and tutors at work in the laboratory.

In this laboratory, the students learn:

- Strategies of warehousing, of order picking and common logistics strategies and rules like KANBAN.
- Methods to optimise processes.
- Methods and different kinds of communication.
- How and where information processes can be automated.
- How is the material flow between factory – warehouse and customer to be organised.
- How are the flows of empty boxes, cartons and waste to be organised.
- How the information flow between the customer and the order taking office of the warehouse is to be organised and which other information flows are necessary to fulfil the order in the right manner.
- The dependence between information flow and material flow.
- How the financial flow is to be organised as a whole.
- Which problems and failures are typical and have to be solved by standard processes.
- Which problems should be solved by fast-tracked problem solving.
- Organisation of working places.

The ten working places with their main tasks are:

1. Customer (gives the order, changes the order, asks for the status of the order, checks the delivery, claims if necessary, pays the order);
2. Order taking office (communicates with the customer, takes the order, verifies the order, collects all data of the order, transmits the data to the dispatch and finance manager);
3. Dispatch and finance manager (disposes the orders to delivery tours, creates the delivery notes and the bill);
4. Commission manager (makes intern orders and gives them to the picker);
5. Picker (pulls the orders, picks the goods according the orders, checks his work by his own, transports the boxes to the packer);
6. Packer (checks the number of goods according to the order of the customer, verifies the completeness of the order, packs the goods, addresses the packaging);
7. Freight forwarder carrier (does the transport of goods to the customer);
8. Producer (produces goods, puts them into boxes);
9. Reception of goods (checks all deliveries, pays for the deliveries);
10. Warehouse manager (manages the puffer stock, realises input in the flow rack, checks the inventory).

LABORATORY FOR MOVING LOGISTICS ASSETS *LOGMOTIONLAB*

The Fraunhofer IFF *LogMotionLab* provides support to face the new challenges in logistics successfully. In the LogMotionLab RFID technologies are tested and neutrally assessed for their practicability for specific business processes. More information about the LogMotionLab is available in Ref. [10].

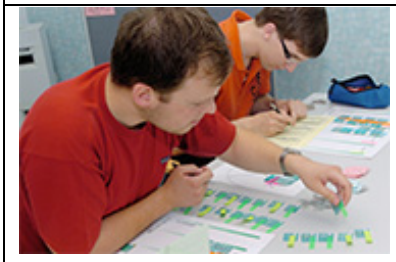
The laboratory is a very useful experience field for the students in Magdeburg as they will become familiar, for example, with:

- data carriers for use in the industrial environment;
- demonstrators for presenting typical RFID scenarios;
- technologies for localising assets indoors and outdoors (RFID, wireless LAN, GPS, GSM);
- infrastructure for piloting and customised solutions;
- devices for communication.

MANAGEMENT GAMES

Playing a management game helps to employ the knowledge acquired with a long-lasting effect [8]. As a rule, a management game seminar involves a 1.5 day course with part theory and part game. There are different management games used in Magdeburg [9]. Some of them are listed in Table 2.

Table 2: Two examples of management games [10].

| | |
|---|---|
|  <br>Prepares upper level university students as well as experts and executives from industry for the challenge of maintenance and spare parts logistics; 6-12 players. | GINGER - Maintenance and Spare Parts Logistics Management Game<br><br>The manual management game GINGER tangibly and vividly describes the interrelationships and dependencies between production, maintenance and spare parts supply. In the process, it demonstrates challenges and approaches in the holistic management of maintenance and spare parts logistics. Predetermined, condition based and corrective maintenance strategies are taught with appropriate spare parts logistics strategies. |
|  <br>Prepares university students as well as specialists and executives from industry for the challenge of Supply Chain Management; 8-14 players. | SILKE - SCM Management Game - Control of Integrated Supply Chains [8].<br><br>The management board game SILKE demonstrates the fields of problems and solutions when managing multistage supply chains with intra-company and inter-company processes. Apart from general logistics tasks, such as production programme planning, capacity planning and the MRPII concept, primarily more complex correlations of Supply Chain Management are presented and clearly resolved. |

SUMMARY

The mix of special learning arrangements, training, practical experience, self-studies and management games have been delivering optimal performance in practice for some years.

Academic education in logistics at the University of Magdeburg has been evaluated and ranked highly in Germany by several independent evaluation institutions.

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