ACADEMIC EDUCATION IN LOGISTICS USING DIFFERENT FORMS OF PRACTICAL TRAININGS

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Abstract: The academic education should prepare the students for their profession in an effective and efficient manner. The most important individual factors of success in the profession of a logistician are: Sense of responsibility, customer-orientated, aim-orientated, self-motivated, 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 competences, integrity, self-reflection, ecological thinking, mobility, international skills, learning abilities and management skills. Today academic courses in logistics are not longer conceivable without any modern teaching methods aided by modern I&C technologies. In the following some highlights of the educational program of logistics at the university in Magdeburg are presented. These teaching forms are also the result of international cooperation.

Keywords: Academic education, logistics, management games, practical training,

1. Logistics in Magdeburg

Every year, over 600 students get their education in logistics at the OvGU in Magdeburg. They are studying in 9 different academic courses within 4 different faculties:

Faculty of mechanical engineering:
- Industrial Engineering in Logistics (Bachelor, Master),
- Industrial Engineering in Mechanical Engineering (Bachelor),
- Mechanical Engineering (Bachelor).

Faculty of systems and process engineering:
- Safety and danger prevention Engineering (Master).

Faculty of informatics:
- Informatics and Industrial Informatics (Bachelor, Master).

Faculty of human and social science:
- Cultural Engineering (Cultural science – knowledge management and logistics) (Bachelor, Master).

Each of these nine academic courses should have a common part of education in logistics, but it is also necessary to teach logistics according to the special application areas from the event manager to the global industrial player.
Three Highlights of the education in Magdeburg are:
- Analysis of logistical processes and logistics planning with VR technologies,
- The laboratory for order picking / order fulfillment (warehouse),
- Management games (Figure 1.) and the Fraunhofer IFF lab “LogMotionLab”.

The difficulty in the education is not to teach the use of a method rather it is the challenge to teach the understanding of a method in the context of all activities of a problem solving process at whole. If the knowledge about methods will often be transferred only in a theoretical manner, then often concepts will not be realized, knowledge and tools are not successfully be used in practice. The summary is: it is not enough to know what should be better you have to change it by your own. That is the reason why the academic education in Magdeburg also uses different kinds of practical trainings and management games to generate own practical experiences and competences for the students (Figure 2.).
2. Analysis of logistical processes and logistics planning (Computer lab and VR laboratory)

This VR laboratory looks like a typical computer lab. The lab has twenty places with one laptop per each student. Practical training is done in the following fields: process analysis, logistic planning, information logistics with SAP, modeling, simulation of logistical processes and systems, modeling and simulation projects.

2.1 Database of logistical methods (mlog)

The methods in logistics are used all over the world and therefore they should be accessible from anywhere, too [1.]. As a global science there is the need to be provided the methods in several languages. Besides to this a presentation and editing opportunity via internet based technologies has to allow a cooperative definition and constant change of provided method content and translation as well.

During the last years a logistical methods database, named mlog, has been developed. In this project are involved the Otto-von-Guericke-University Magdeburg and their partners in Miskolc and Santa Clara, too. The vision of mlog is to be used as a comfortable, evaluated supporting system for students, engineers and managers in logistics around the world. The method database mlog is currently only a first prototype to evaluate the progress and state of research of methodical knowledge in logistics. Mlog has two important advantages: firstly mlog makes it possible to validate and verify ideas in method research and secondly it makes it possible to use a new perspective on methodical knowledge to improve research (see Figure 3). The core of the method database mlog (Figure 2.) consists of several widely integrated modules. The core module includes the presentation module for methods. Therewith it is possible to show method content as a webpage on the internet or a webpage for printing. It also allows to create the pdf files for online and offline reading. Several search mechanisms are 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. Mind maps in the kind of meta-knowledge for typical tasks in logistics are involved too.

Next to the search mechanisms an internal messaging system has been implemented with two main tasks. Firstly the messaging system is used for the assessment of methods. Users are able to assess methods directly from the display page by giving advice and comments to the method's author. Secondly the messaging system is used to support cooperative work in creating methods by allowing communication among method developers and users. A management module to support the administration tasks of this complex database-driven online application has also been developed. Tasks supported by this tool of the actual prototype include creation and change of content for different kinds of users:

- method content like description, references, graphics,
- literature references e.g. books, scripts and websites (URLs),
- user entries including username, password, statistical data,
- supporting information as glossary and FAQ,
- index as a search tool.

The newest development includes the online calculation module. It creates calculation support for numerical calculation and dimensioning methods in logistical engineering.

For future development the following three steps are to be fulfilled:

1. completion of the development of the online calculation tool,
2. introduction of method interaction abilities and,
2.2 Effective and efficient processes by using methods of Quality Management in Logistics

Everyone knows that failures are happening anywhere, also inside logistical processes and systems. That is why Quality management methods are one big field in logistics. There are also given a lot of possibilities to improve processes according to the philosophies of Business Process Reengineering and Kaizen. The task is to create processes both effective and efficient. This task is not an easy one, especially in logistical networks where a failure can have a lot of causes. A teaching book was written which deals with this topic in cooperation with the three universities Magdeburg / Germany, Santa Clara / Cuba (Prof. Dr.-Ing. Norge I. Coello Machado) and Miskolc /Hungary (Prof. Dr. habil. Béla Illés) [12.], [13.]

It was published in German and Hungarian. The Spanish version will be finished and published in the year 2010.

Logistics process analysis starts with the term of the logistical quality at whole. Logistical quality can be defined as the degree of a logistical process to fulfill the requirements of the customers in the sense of the EN ISO 9000:2005 [2.]. The customer satisfaction is the most important one when discussing quality issues.

Customer satisfaction is defined in [2.] as customer perception of the degree to which the customer requirements have been fulfilled. Characteristics are the capability to deliver, the time needed for delivery and punctuality. To assure the quality of logistical processes it is necessary to deal with failures and defects. Therefore, standard processes need to be developed to do that in a systematic and holistic way. The use of the well known QM-methods makes it possible to recognize failures and their causes in order to analyze logistical processes and systems (Figure 4.).
In the computer laboratory all these methods are practical trained. Therefore Microsoft Excel, Microsoft Visio, SPSS and a lot of other standard software is used: The main idea is to gain own experiences to practise problem solving processes by using logistics methods and to make a practical discussion about them. After finishing the training the students should have so created their own tool-set to solve problems in practice (Figure 5.).

The practical education is done as following: Every student has to download four databases at the beginning of the practical training: Theoretical background and task, one solved example as a reference solution, own data and space to develop the own solution of the task. So 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 by her/his own. This can be done in the laboratory with the possibility to be coached by the tutor or self organized at home. The focus of the training is to get an own competence in practical problem solving. The solutions of each task have to be send by email to the tutor. At the next practical training a collective feedback is given to all students with a short verbal reflection about problems, difficulties, misunderstandings, hints and some new ideas to improve or modify the methods and the problem solving way at whole.
2.3. Bicycle factory – student in the role of a controller in a mix of self-study task and computer game

Each professor knows this fact: It is not very interesting to teach indicators to students. That is why it is useful to do that in a special manner. Therefore a computer game is used in Magdeburg, in which the student takes on the role of the controller of a factory which produces bicycles. (Figure 6.) The little story of the computer game tells that the boss will await the new controller (student) for a brief report in his office. He is interested in how the new controller will interpret the logistics indicators. The controller (our student) has to evaluate the current situation. Therefore indicators are necessary, therefore the knowledge is required which indicators do exist [5.][6.][7.] it is necessary the knowledge about how to calculate them and which data is necessary. The data is stored in the same data base as in reality. Some data is missing (like in reality) and the student has to assume this. Some information they get from video, others from reports others from collected data. The results are completely filled Excel-sheets with indicators and individual comments.

Figure 6. Bicycle factory (Available in German and English) www.ilm.ovgu.de/fahrradfabrik

According to the VDI 4400 guidelines (VDI = Council of German Engineers)

The tasks of the students are:
- to understand and accept the task and the role of the controller,
- to get an overview about the company and about the single departments,
- to make a self study about indicators,
- to find or to assume the data which is necessary,
- to calculate the indicators in the right manner [VDI 4400],
- to interpret the indicators (with colours like the traffic lights),
- to evaluate the current situation at whole and in detail,
- to give suggestions to improve the processes.

2.4 Logistic planning with VR technologies

Another self-study work is to create a planning concept for a distribution centre. The students download the task and a lot of data. The task is coached by tutors. The tutors are students who are shortly before finishing their studies. For the task the participants will be divided into little teams. Each student team has a number of two students. At first each student team
has to do a theoretical work with a lot of 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 prognosis of the future development and e.g. 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 gives the student also a fast feedback about his work. A useful, intelligent and also very “nice” solution makes her/him proudly about her/his own work and provides a very good motivation. Important results are the model, the kind and number of technical equipment and the invest costs at whole.

TaraVRbuilder is a software tool for the 3D configuration and time-based simulation of conveying, material flow and storage/warehouse equipment using virtual reality technology. The program is used to visualize and analyze plants. Possible applications exist in the fields of sales support, planning, engineering and documentation.

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

3. The laboratory for order picking / order fulfillment (lab warehouse)

Ten students and one coach can make a realistic role-play in the lab warehouse. The core of the lab are picking processes and warehousing of five pharmaceutical products.
In this laboratory the students learn strategies of warehousing, of order picking and common logistics strategies and rules like KANBAN, methods to optimize 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 organized, how are the flows of empty boxes, cartons and waste to be organized, how the information flow between the customer and the order taking office of the warehouse is to be organized and which other information flows are necessary to fulfill the order in the right manner, the dependence between information flow and material flow, how the financial flow is to be organized at whole, which problems and failures are typical and have to be solved by standard processes, which problems should be solved by fast circles of problem solving, organization 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 internal 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 buffer stock, realizes input in the flow rack, checks the inventory)

Manual games are used at the moment. For the future, the same procedures will be realized by using SAP and smart label - aiding processes.

4. Longlasting effects by playing Management games

Playing a management game helps employ the knowledge acquired with a long-lasting effect. (Compare [8.]) As a rule, a management game seminar involves about a 1.5 day-course with one part “theory” and another part “game”. There are seven different
management games used inside the logistical academic education in Magdeburg. (Compare [9.]) Some of them are listed in Table 1.

Table 1. Some examples of Management games in Magdeburg [10.]

<table>
<thead>
<tr>
<th>Game</th>
<th>Description</th>
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<tr>
<td><strong>GINGER</strong> - Maintenance and Spare Parts Logistics Management Game</td>
<td>Integrated Management of Maintenance and Spare Parts. Companies have to be customer oriented. 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. The management game's modular design keeps it flexible for 6-12 players. At the same time, its complexity and thus the requirements can be adapted according to the background knowledge of the players.</td>
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<tr>
<td><strong>SILKE</strong> - SCM Management Game – (Comp. [8.]) Control of Integrated Supply Chains.</td>
<td>The management board game SILKE demonstrates the fields of problems and methods of solution when managing multistage supply chains with intra-company and inter-company processes. Apart from general logistical tasks such as production program planning, capacity planning and the MRPII concept, primarily more complex correlations of Supply Chain Management are presented and clearly resolved. What is more, the most recent results from SCM research are put into management game practice. Its modular structure keeps the management game flexible for 8-14 players. At the same time, customizing the complexity becomes possible and thus the level of requirements on players' preparatory training. Diversification of the supply chain is also possible during the seminar in order to accommodate the learning effect.</td>
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5. Laboratory for Moving Logistics Assets (LogMotionLab)

The Fraunhofer IFF LogMotionLab provides support to face the new challenges in logistics successfully in cooperation with the Institute for Logistics and Material handling systems of the Otto-von-Guericke-University Magdeburg. In the LogMotionLab RFID technologies are tested and neutrally assessed for their practicability for specific business processes. The lab is a high-tech-learning platform for the students in Magdeburg e.g. in the sense of the following:

- Data carriers for use in the industrial environment
- Demonstrators for demonstrating typical RFID scenarios
- Technologies for localizing assets indoors and outdoors (RFID, wireless LAN, GPS, GSM)
- Infrastructure for piloting and customized solutions
- Devices for Communication

More information from the LogMotionLab is available in [10].

6. Summary

The mix of different kinds of special learning arrangements, trainings, practical experiences, self studies and management games have been delivering optimal performance in practice for some years. That is also one important reason why the academic education in logistics at the university in Magdeburg has been evaluated and ranked on a top position in Germany by several independent evaluation institutes.

Literature

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