



PRACTICAL EDUCATION OF YOUNG ACADEMICS FOR RAILWAY OPERATION AND RESEARCH

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Education is one central aspect for winning and qualifying employees for railway operation and research. Most of the courses in this field are conventional organised by ex-cathedra teaching. Modern interactive forms of further education like business games or role-games are found. The advantage of these forms is that the participant can sample different roles, their relationship and the dependencies. Especially complex topics with different actors can be presented and sampled in this way very descriptively with the effect that the participants better understand and remind the topic. In this paper a business game for the topic planning and management of train paths is elaborated. This new seminar will replenish the existing educational program of the railway operation research centre which will be introduced at first.

1. Introduction

Skills shortage and aging of employees are recent topics research facilities and enterprises in the field of railway operation are faced. These topics can cause a decrease of knowledge in certain areas. To counteract this development it is necessary that young motivated engineers, scientists and other qualified employees can be won for the railway operation sector. One central aspect for winning new and qualified employees is education and professional training. The above mentioned aspects shall be considered in the concepts for education and professional trainings. With an attractive education more employees can be won for the railway business.

The TU Darmstadt has developed two ways to win qualified employees for railway operation: On the one hand students und young researchers shall be motivated and fascinated for the wide field of railway operation and research. On the other hand employees working in the field of railway operation or closed-by fields shall get an overview of the complexity of the railway business and be qualified for specific themes.

In the following the railway operation research centre at the TU Darmstadt and the possibilities in use for education and qualification will be introduced. In the focus of this paper a new developed business game, the aims of it, the applied methods and the structure of the game will be presented.

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2. The railway operation research centre

In the following the railway operation research centre, the installed technical equipment, the simulation possibilities and the resulting fields of application are presented, especially in the field of education.

2.1. Technical design of the railway operation research centre

The railway operation research centre (EBD – Eisenbahnbetriebsfeld Darmstadt) is a model railway with authentic signalling and interlocking technique for teaching and research purposes [1]. At the EBD almost 1,000 metres of track to a scale of 1:87 (size H0) are installed. With a modified track scale of 1:250 to satisfy the need for greater track length, the EBD provides 90 km of main and branch lines. Figure 1 gives an overview of the existing line concept. The model system consists of a double-track railway ring, a single track line, and a dual link.

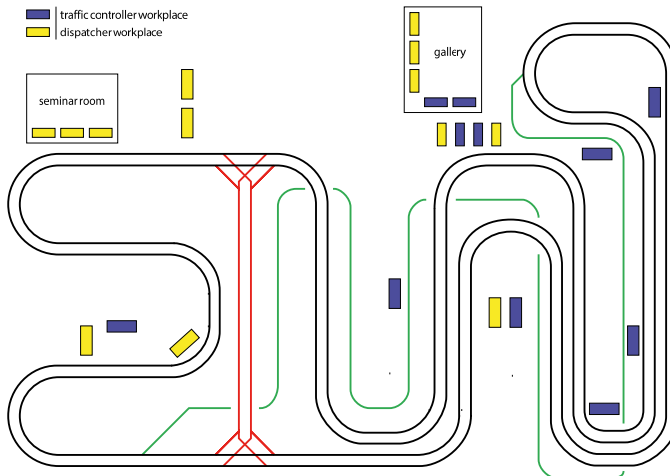


Figure 1: Overview of line concept of the EBD

The facility consists of 13 stations, 160 main tracks and 360 switches and derailleurs. The following interlocking techniques are installed at the EBD:

- mechanical signal boxes,
- electro-mechanical signal boxes,
- relay interlocking systems and
- electronic interlocking systems.

The interlocking techniques are the basic elements for the workplaces for traffic controller and switchmen. Beside different software tools are needed for the workplaces for dispatchers. The different workplaces are illustrated in Figure 1. With the help of the extensive software tool package installed dispatchers have real life systems simulated at EBD. These include all information systems and different personnel and vehicle resource planning software tools [2].

2.2. Field of application

The 2006 opened EBD is operated by a collaboration of DB Training, Learning & Consulting - the qualification and consulting services provider of Deutsche Bahn AG, the Railways Academic Working Group and the Department of Railway Engineering at the TU Darmstadt. Every partner has its own field of application of the EBD. In the following the use by TU Darmstadt is presented.

At the EBD railway operation and corresponding processes can be simulated in real-time [3]. Due to this and the wide range of technical elements, EBD is used for highly versatile training and research purposes.

The TU Darmstadt uses the EBD in the following fields:

- lecture and excursion for students,
- further education for engineering companies and
- research in different projects on behalf of railway and research institutes.

The range of courses for students at the EBD reaches from guided tours in the first week of the study, bachelor grade courses to master grade courses and topics for thesis or project papers. The aim of all these courses is to motivate the students as early as possible for the railway business and to show the diversity of possible applications.

For engineering companies in the railway sector different seminars are offered: The range of seminars reaches from short introducing seminars (typically 4 hours) to intensive courses to the basics of railway operation (typically two or more days). All offered courses and contents of the seminars are adjusted to the needs of the participants and their previous knowledge.

Due to the diversity of railway techniques and software tools, more and more aspects of different research projects are developed and tested at the EBD. Recent research topics are connection dispatching, design of new workplaces for traffic controllers and development of new operating procedures.

The content of the current training opportunities at the EBD include seminars to specific railway operation topics, like the basics of railway operation, the regular railway operation and the handling with deviations in railway operation. All participants get the same perception of the covered topic. In future new courses shall be added with the opportunity for the participants to cover a topic from different views and to act even more interactively. The participants shall get the opportunity to sample different roles of actors in railway operation.

3. Desing of a business game „planning and management of train-paths”

The following chapter describes the reasons for the use of a business game and the opportunities of it. The described motivation is the base for the following description of the rough concept of the business game.

3.1. Motivation

Business games are used in education and economy when the consequences of decisions cannot be identified directly because of their complexity. The use of business games gives the participants the possibility to find out the dependencies and the consequences in a confident environment during the training. [4]

In railway operation different complex issues can be found: reaching from the process of driving a train up to the timetable planning process. All these issues have in common that several participants of different companies are involved. For the single participant it is difficult to value his decision in comparison to the other involved participants. During the business game decisions can be taken without consequences that affect the real railway operation [5].

With the help of a new business game the process planning and management of train-paths shall be presented. The aim of the business game is to introduce the management of train-paths, to identify the tasks of the different participants and their divergent aims and to demonstrate the potential for conflicts in the planning and operation of train-paths.

3.2. Designing the business game

In adult education different ways and concepts for designing courses are possible. Figure 2 shows how people can remember to information and knowledge, which are imparted in different ways. Information especially the content of educational courses are best reminded when the participants have the possibility to do or experience things on their own.

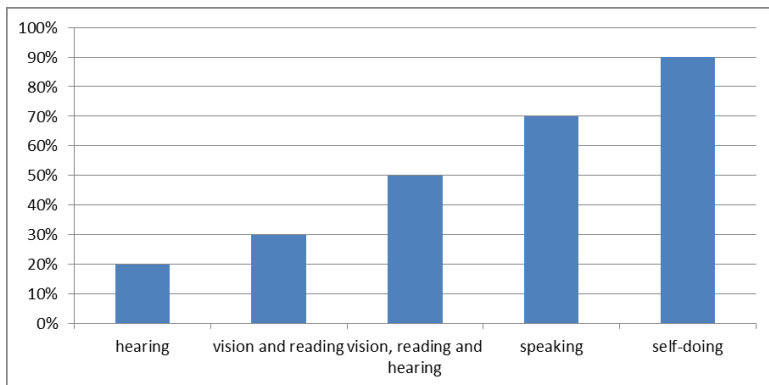


Figure 2: Memory-effect of different ways for information transfer [6]

Derived from this requirement for business games participants should have the possibility to undergo and experience the planning process and the management of train-paths in contrast to just listen to the most important facts of these processes. Furthermore it is necessary to introduce the planning and management of train-paths in theory for the participants as a basic for the following role-game. In this theory

block, according to Figure 2, the basic knowledge shall be imparted to the participants combining at least the communication ways vision, reading and hearing.

For the design-process of the business game it is necessary to know which target audience shall be addressed and which expectations these people have. Based on the aim to win more qualified employees for the railway operation and due to the specific topic of the business game, the audience are young researcher, executives and lateral entrants. All have in common that they have no or only a basic knowledge of planning and management of train-paths.

Before the first concept for the business game can be designed, it is necessary to know which topics and educational objectives the game shall contain. In our case the following processes shall be presented and demonstrated to the participants:

- the announcement of train paths by different rail transport companies,
- the management of the train paths by the railway infrastructure company, and
- the process ‘driving a train’.

3.3. Rough concept

The three above mentioned topics are the basic elements of the business game. In the following the concept of the designed business game is described.

At the beginning of the business game the topic planning and management of train paths will be introduced to the participants. In this theoretical part the participants get all the same knowledge base for the following role-game as described above.

After it the participants are divided into different groups for the role-game: several groups presenting the rail transport companies and one group for the railway infrastructure company. In the following the rail transport companies plan their train paths for the next timetable period based on a given service concept. The result of this work step is a list with all train paths that will be declared to the railway infrastructure company.

During the planning process of the transport companies the participants of the infrastructure company get to know all theoretical basics they need for the management of the train paths: they learn about the fundamentals of the granting of train paths and they get an introduction to the software used for this process.

The declared train paths are the basis for the timetable that will be developed from the infrastructure company. The infrastructure company builds a first version of a timetable with the help of developed software. During this step the transport companies are the contact persons for the infrastructure company when they have to solve conflicts of competing declared train paths. The transport companies have to verify alternative times or routes for their train paths based on the framework given by the infrastructure company. After several loops for solving the conflicts of the declared train paths the infrastructure company publishes the final timetable.

The developed timetable is the basis for the next step – ‘driving a train’. In a first version of the business game all participants undergo the role of a traffic controller or of a switchman. In a later version it is also conceivable that the participants can undergo the role of a dispatcher. All traffic controller workplaces of

the EBD are taken by the participants. Everyone has the timetable for his station or route section. The aim of this section of business game is that the participants gain an insight into the complexity of this process. Measures for the success of the participants and for the developed timetable are the delay-minutes.

4. Discussion

- With the help of the developed business game young researchers, executives and career changers have the possibility to get to know the different divergent aims of all participants of the planning, announcement and management of train paths and of the operation of trains. They also get a feeling for the complexity of the railway operation.
- It is possible to add different associated aspects to the business game, like the dispatching of train paths, the handling with deviation from the normal train operation or the information of the customers.
- With the application of the business game or parts of it in the education it is possible to address students and young researchers and to motivate and elate them for railway operation.
- The idea and concept of the developed business game is transferable to other topics of railway operation. Maybe also for other engineering disciplines.

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