



SIMTEB

Simulator-based Training
for European Bus Drivers



Lifelong
Learning

SIMTEB:

Simulator-based training for European bus drivers

Transfer and implementation of an innovative training concept for drivers and trainers in initial and continuing education organizations in the public transport in Europe

WP 4: Train the trainer (Result 4)

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Preliminaries

The Guide "train the trainer" aims at instructors that are planning or performing training for bus drivers and use a driving simulation as part of the training.

The Guide sees itself as an orientation guide for trainers, who want newly deal with this approach and learn about the effects of training with simulation in comparison to other approaches. The information presented about training procedures for "EcoDriving seminars" can be used without much customization effort for the own planning, but should always be adapted to the individual needs of the subject and the audience. Similar to other seminars a fine tuning is useful after a workout or several training to incorporate the results of the conducted trainings in the concept.

1 Comparison of different training methods and reasons for their use

As it is always useful to employ several methods in training, a brief view on the methods, which were used in the framework of the project or are suitable for the transfer of knowledge for single - or multi-day training, follows.

1.1 Method lecture

The lecture is the classical method for the (short) mediation of information, which was not known by the target group in this form so far. In addition, the lecture is suitable to summarize important arguments or represent the statements about a topic that can be used as the basis for the subsequent processing with the group. Nowadays, to present the statements of a lecture, mostly (PowerPoint) slides are used. The features of designing such slides are disregarded here, as they go beyond the scope of this paper.

For the topic of EcoDriving, this method is suitable, but only very limited, because most drivers are familiar with a basic knowledge about economic driving. Therefore, the most important facts and factors influencing on the subject of EcoDriving can be represented well.

Long-lasting lectures or a series of slides with statements about EcoDriving would therefore quickly bore the group and the desired content-related discussion of the subject would fail. A coach should use this method only to a small degree (about 15-20 minutes), but repeatedly during a training day.

There are a number of publications about the principles of lectures that can be observed. Therefore, what follows is just a short listing of some important advantages and disadvantages associated with this method.

Advantages:

- Presenting the facts can be done shortly and briefly.
- A once prepared lecture can be repeated as often as desired.
- The presenter is not dependent on the cooperation of the participants and can thus push/pull through his program.

What initially represents an advantage can also fast change to the detriment of it. If this method is overused and more or less the only method for a training day, most participants are not able to assimilate the information, and the performance of the speakers is cancelled out.

Disadvantages:

- The presenter "sticks" to his post once prepared and does not mention the specific needs of the target group.
- Because the speaker is not dependent on the cooperation of the participants, he cannot be sure whether he meets their interests, uses appropriate examples, etc.
- Incorrect design of slides makes it hard for the students to understand the content, e.g. using inconvenient colours, overload with text, use of inappropriate effects, etc.
- When using slides, there is the danger that they are only read aloud, this has very tiring effect on the listeners.

The time of full attention during a lecture is – except for a few exceptions – usually 15 minutes or less.

Therefore lectures play only a minor role in the conception of a simulator-based eco-training. For that reason no further arguments of advantages and disadvantages are explained at this point.

1.2 Method Talks and Discussions

A discussion is a conversation between two or more people, where the respective arguments are exchanged on the subject. Through direct speech and conversational exchange the own point of view can be presented and the other position will be met.

The purpose of a discussion is not necessarily to convince others of the own point of view. However, at the end of a discussion it is the goal to find a solution for a problem, a mutually acceptable compromise, or both sides recognizing that different opinions exist. In such a case, the discussion is an important way to recognize the point of view of others and to see things from a so far unknown perspective.

Advantages:

- Active participants can bring their views and their experiences into the training. This increases their motivation to deal with the issues.
- The participants are forced to make their own thoughts to the topics presented.
- The participants can / should deal with the arguments of the others to reconsider their own position.

Disadvantages:

- It often happens that only a few students are involved in the talks and discussions. Everyone else is listening or – in the worst case – having shut down and missing the content discussed.
- In some cases there are emerging group leaders. This might convince the others, despite the fact that the presented opinion is wrong.
- It might happen that not so eloquent participants are not able to represent their "correct" arguments in a convincing matter and their meaningful contribution may be lost.

It is the task of a coach (moderator) to make sure that as many arguments (pro and contra) each topic are named to achieve a diversity of opinion. In the remainder of the seminar these arguments can be used - as far as possible together with the group – to develop new rules and hints.

Conclusion: This method is suitable for EcoDrive trainings to collect experience from the participants and to make these known to all other.

1.3 Method pair work or group work

The underlying condition of partners or group work with experienced bus drivers is assuming that there are substantive, technical knowledge and precognition and as well as a lot of (sometimes very different) experience on the topic.

It's now about making this knowledge and experience transparent for all other participants.

Therefore the group work continues the previously described talks/discussions in a special way. It is no longer about discussing with the entire group, but only in small groups. To do this, at least 2 persons are required (pair work). Useful groups turned out to consist of 3 to 4 participants. This emerges a greater diversity of opinion on the one hand, and on the other hand everyone will be compelled to cooperate by the limited number of participants.

Group work is initiated by the trainer who specifies topic and time frame. The theme can be shown e.g. on a prepared sheet or being represented as a task on a flip chart. The task can be the same

for all of the groups or with (slight) variations focusing on different aspects of the themes. After finishing the group work, each group must give a (short) presentation about their findings.

Group work is e.g. suitable for the elaboration of different behaviour styles while driving busses with manual transmission versus buses with automatic gearing as part of an EcoDriving. More sub-topics: behaviour in rush hour or at off-peak times.

Advantages:

- Participants can concentrate on doing a specific theme.
- Several aspects can be developed by various groups and presented to each other.
- Participants defend the arguments when presenting their results to the group and try to convince the others of the correctness.

Disadvantages:

- Time consuming.
- Participants are overcharged if missing previous knowledge.
- Corrections are required if participants make false statements.

Results of a working group and group discussion are easier accepted by training participants, as if there would be statements of the trainer. Drivers who (with the support of the coach) develop independently the "golden rules" in a group work find it is easier to implement them in their practical work.

Conclusions: Working groups and group discussions are valuable methods for a simulator-based EcoDrive training.

1.4 Method Simulator usage

A bus simulator is primarily a technical tool to recreate the reality and by using the simulator certain features and behaviours can be tested within the simulation. It must be clear for every trainer and for each trainee, that the simulator is not the full reality (in most cases) and that it also does not exactly drives like a 'normal' bus. There can always be differences determined, due to the fact that acceleration and braking, and the G forces are having a different impact on the simulator driver. It is necessary that the coach communicates this to the participants in order to avoid any false expectations. In addition it is important that the coach delimits the bus simulation from simulator games. The trainer must make clear that the objectives pursued by PC software or simulated car and bus rides on game consoles are not professional training. The driving behaviour of the vehicles as well as the behaviour of the environment and also the consequences of making mistakes is different in both worlds.

Therefore, the use of a simulator must be specially planned by the trainer.

In contrast to the practical part of driving in a traditional EcoDrive training, where usually only the driver and the trainer can evaluate the ongoing processes, using a simulation provides the chance of monitoring a variety of parameters and behaviours for the entire group while one of the participants is driving in the simulator. This is a very effective way of transferring knowledge, because there is no "idle time", but all participants can participate actively at all exercises. To achieve the involvement of the participants observation tasks could or better should be distributed. Tasks are e.g. the observation of speed, the revolutions, the number of gear switches or the number of full stops at the simulator ride. So all participants are integrated in the ride and can contribute during the evaluation phase with their observed data. When changing the driver of the simulator, the observing task for the other students should change as well, as this promotes a change of perspective.

Advantages:

- After a short familiarization the driver will have an intense experience in the simulated world, comparable to familiar situations in the real world.
- At the simulator all students are involved fully in the process of forming an experience about the possibilities of EcoDriving.
- In the various stages of training it makes sense to let the participants try out different driving styles and the effects can be analysed immediately.
- When using the simulator, all parameters of a situation (exercise) can be controlled and can be used once again in a repetition of the exercise.
- There are a variety of evaluation features. In addition to the evaluation of vehicle data (consumption, number of gear switches,) unclear situations can be repeated. Active, by driving again or passive, by the replay of recorded exercise.

Disadvantages:

- Hardware and equipment must be available
- The trainer must have a special training in using the simulator (see also points 5 and 7).

Conclusions: Using a bus Simulator opens a variety of training opportunities that go far beyond the practical use of a bus for EcoDriving. Participants are intensively involved throughout the whole time of the learning process. They can have an intense debate about the topic.

1.5 Combination possibilities and reasons for the use of active methods

At many continuing education events for bus drivers the participants are only minorly involved in the seminar process. This often leads to boredom and in the worst case to a mental log off. The

time is only served; there is no learning effect, rather even a negative attitude towards these types of events. By activating methods, in most cases this can be avoided. Participants in these seminars are often amazed that the end of the event has already been reached. Therefore it appears likely to use different (activating) methods.

Basically there is multitude of other possibilities available in addition to the methods described above in order to make a seminar interesting and successful for participants. The combination of several methods and a change of method aims to keep the attention of the participant. For most people the channels that they can record information with (hear, see, do yourself...) are developed differently. It is therefore useful to encourage all these senses/channels in a training to give all participants the opportunity of an optimal way to collect the information. The target group of bus drivers attends continuing education events only rarely (compared to other occupational groups) and is therefore rather learning unfamiliar. The design of a seminar also has to respect this.

2 Pros and cons of using a simulator for training (pedagogical and didactical aspects)

Using a simulator for driver training has a number of consequences that have an effect on organizational and pedagogical/didactic impacts of training.

As driving simulation both – mobile and stationary systems – are in use. In most cases training will be carried out in separate training buildings or rooms. The simulator should be available there. For fixed systems, the amount of space required is already made available. For mobile systems it is necessary to ensure an appropriate space. In both cases it is an advantage that manoeuvres can be carried out directly at the training location and travelling to a separate training ground is avoided.

The exercises on a simulator are sensibly (wisely) stored in an exercise library. This allows running exercises repeatedly following the same schema. In this case, the exercise conditions are the same for all participants. In addition, variations of the exercises can be saved to achieve special effects.

Exercises using the simulator can be repeated as often as necessary. The desired (modified) behaviour can be achieved in a short time through that kind of intensive training and practice.

An important feature in the application of simulation systems is the ability to record the whole exercise. This can be used in the improvement phase together with the trainee to evaluate which part of the behaviour was correct and where there is still a need for improvement. The recording is "neutral" and does not reproduce the impressions/memories of the student or the trainer.

A detailed evaluation based on previously defined parameters can be used for a systematic analysis of the changes in behaviour of a trainee during several trips with the same task (e.g. economical driving). The improvements achieved can be determined directly.

Each simulation is a reduced image of the reality. Bus simulators used for education and training can and shall therefore behave like a real vehicle. Though, there is always a difference between the bus drivers are used, and a simulation. Therefore, in most cases a familiarization (habituation) to the diversity is necessary and an important step towards the acceptance of the method.

The simulator can be used only with restrictions in extreme traffic situations. The dynamic properties can be calculated and displayed, but the physical impression when accelerating, braking or lateral breaking out (positive, negative or to the side) is always very limited and at odds with reality. But such situations are not in the centre of an EcoDrive Training.

In summary it can be stated that selectively using a bus simulator can achieve a series of training objectives, which would not be possible with other methods or only by increased time or human effort. It is important to align the design of the simulator and the training goals and to achieve a target-appropriate design of the manoeuvres.

3 Training focus: EcoDriving

The use of driving simulations for the topic of EcoDriving is suited for initial and advanced training of bus drivers. A one-day seminar (7 hours in accordance with EU directive) is to align to the needs of the target group.

In an initial training the focus is not to improve the previous patterns of behaviour due to the low experience of the drivers, rather to train for the first behaviours that allow an EcoDriving later.

As a seminar for experienced drivers the design has to include previous experiences of the target group. A seminar is only successful if the active participation of the students can be reached. Active stakes of the participants are an important part. This way, the participants can engage in the discussion using their experiences. They can learn about the views and experiences from others and they can check their own point of view on the subject of EcoDriving and correct it if necessary.

The concept therefore envisages to collect statements during the round of introductions and to document their "special experiences" e.g. on cards. By that the participants are making the topic of the seminar to their own, they are affected by the topic.

When introducing the simulator, the trainer has to reduce or to counteract fears and obstacles to the use of the new technology. Although participants often don't voice their scepticism the fear that

they will fail exists. Everyone feels watched and under observation. Emerging problems with mood disorders (simulator sickness) can be accessed immediately and mitigate the problem through suitable driving.

Doing the first simulator ride without any special reference to the expected behaviour the bus driver should show their normal behaviour on a specially designed scenario. This scenario (see point 4) is to ensure that special behaviours can be addressed later in the seminar, to make the effect of the EcoDriving transparent, for example the rolling of the bus arriving at a bus stop or approaching a crossing. The drivers experience can be reinforced by giving observing tasks to the other participants that can be analysed at a later stage of the seminar.

After all participants have completed this first trip, the focus of the EcoDriving must be reclaimed. To do this, the form of a lecture would not meet the needs of the target group and not fit to the desired change in behaviour. Prepared slides or flip charts can be just the starting point for the moderator to enter into a discussion with the participants or for a group or pair work on partial issues. About one hour is necessary to be provided for the refurbishment of the main influence factors in EcoDriving. It is then time to develop the "golden rules" together with the drivers.

A period of practical experience on the simulator is required to try out the feasibility of the application of the "golden rules". The trainer can deliberately intervene in the behaviour and so explain the differences between the existing and desired new behaviour. In most cases, it is not a dramatically change, but an effect of small steps. This allows the participants to accept these changes and to integrate them in everyday driving.

At the second simulator ride (comparison test drive), i.e. without influence of the coach, it can be verified whether the application of the "golden rules" is feasible and what results can be achieved then (E.g. same time, fewer stops, less consumption).

Usefully the previously conducted observations can be carried out again and the resulting changes can be documented. In the final evaluation these data provide a good argument basis for the aspired change in behaviour in everyday driving.

When all participants have completed this journey, a final evaluation of the achieved results is important. At this stage the trainer determines, together with the participants whether and how EcoDriving can be used.

Finally, a summary of the daily schedule is useful. The participants can once again give an assessment in how far they can or want to keep in mind the "golden rules" in future.

As other kind of trainings, the EcoDriving training focuses only on certain aspects which relate to everyday driving of professional drivers. In addition to the main topic, also other topics are touched, e.g. passenger safety or material saving driving.

This concept focusing on EcoDriving can be used similarly for other topic areas. Often, only minor adjustments are necessary. This relates to the content of the knowledge transfer and the design of the driving scenarios.

4 Description of the available training units: Simulator exercises, lectures, discussions

General aspects of designing a simulator based training: Seminars can be arranged as a "modular" system. The available parts can be tailored to the needs of the participants and/or the company. This can also be done by variations, where e.g. the first and the second simulator ride can be identical or different.

As an example a training "EcoDriving" using the simulator is presented on the following pages (schedule, time, parts) that were used in a similar way in the frame of the project SIMTEB in Finland and in Germany.

The tabular representation contains the following columns:

- Time
- Topic
- Objective
- Content
- Method
- Comments

The training concept is designed for a number of 6 bus drivers. This can be handled by a trainer and ensures that all involved are always usefully integrated into the training process.

| Time | Theme | Objective | Content | Method | Comments |
|---------------|---------------------------------|---|---|---|--|
| 08:00 – 08:15 | Welcome and overview of the day | Informing the participants about the training program | The trainer shows detailed the process of training and answers the arising questions of the participants to the training | Lecture / discussion with flip chart / prepared documents | |
| 08:15 – 08:45 | Presentation round | Take the participants from their everyday life situation to the training, Eco-Driving simulator using | Discussion of the question: "What stops me in everyday life, to practice an ecological driving?" The results are summarized and used as a starting point for the simulator-based training | Discussion / flip chart or cards to fix the statements | In addition also the expectations of the participants can be collected |
| 08:45 – 08:50 | Features of the simulator | Familiarize participants with the simulator | Specifics of the simulator to a real vehicle are presented and clarified in questions of the participants | Trainer, Simulator | |
| 08:50 – 09:30 | Familiarization trip | Familiarize participants with the driving behaviour of the Simulator | Brake, accelerate, auxiliary brakes, etc. Braking exercises at different speeds, also brake and steer. Double speed < 4 cores per braking distance, etc. | Explanations of the coach to the other participants | Each participant about 4-5 min, simple rides! Observe whether mood disturbance occurs and intervene immediately. |
| 09:30 – 09:45 | Break | | | | |

| Time | Theme | Objective | Content | Method | Comments |
|---------------|--|---|---|---|---|
| 09:45 – 10:45 | First ride (ca. 6-8 min per participant) 9 minutes including change-over times | Determination of the behaviour of the participants at the beginning of the training. Documentation of travel time, distance, consumption, emission. | The first trip includes conditions of an environment of a transport (topography of the routes and route, weather, traffic, etc.) which provides good opportunities to fuel savings through an eco-driving. The basis for a final comparison evaluation of training in the simulator is created with the documentation of the first practice ride. | Watch / other participants have monitoring tasks | Scenario "First ride" |
| 10:45 – 11:00 | Debriefing - after meeting with the participants | Clarification of the potentials of eco-friendly driving | The coach gives feedback to participants on the basis of documented performance of the first practice ride, to what extent they already exploit the potential of eco-friendly driving, and where a change in driving behaviour to necessary | Teaching conversation and discussion | Flip chart Pin board |
| 11:00 – 12:30 | EcoDriving - golden rules | Clarify expectations of the company and of the policy (CO2 reductions) | Fuel costs, CO2, data, vehicle data, effective driving, resistances, Golden rules | Lecture, discussion group / partner work | Discussions with the participants. Enable all participants! |
| 12:30 – 13:00 | Break | | | | |
| 13:00 – 13:15 | Golden rules for bus drivers | Knowing how, thanks to EcoDriving the driving behaviour has changed | Repetition of the golden rules | Conversation / flip chart | |
| 13:15 – 14:15 | Individual driving training, 5 minutes per participant | In-depth error analysis and identification of individual training needs | Mirroring the behaviour in the simulator by the coach. Dialogue with the participants about strengths and weaknesses of their | Simulator ride, analysis of the recorded parameters | |

| Time | Theme | Objective | Content | Method | Comments |
|---------------|--|--|---|--------------|----------|
| | | | riding style and analysis of the causes of individual training needs. E.g. quickly accelerating to optimal speed and the switching operation is carried out accordingly (manual transmission). The actuation of the gas pedal is tailored to the speed range. The speed is observed during the ride. | | |
| 14:15 – 14:30 | Break | | | | |
| 14:30 – 15:40 | Second drive: check ride with an individual debriefing | Determining the driving behaviour of participants at the end of training | Drive under the same conditions as first drive, ability to compare the obtained values. | | |
| 15:40 – 16:00 | Debriefing | Allow for implementation of the learned in the practice (sustainability) | Tips for the practical implementation | Conversation | |

5 Role of the trainer

The trainer as a factor is always important at a seminar that deals with behaviour-influencing content. The use of a simulator is no exception. Only if the trainer is able to communicate the topic e.g. EcoDrive training, in a believable and comprehensible manner, the seminar can achieve a change in driving behaviour of the bus driver in the medium and long run.

First step is therefore, using the example of EcoDrive training, the awareness of participants for acceptance of knowledge. The content of this can deal with EcoDriving, is however not a mandatory requirement for a "wake-up" of the participants. It can also be a simple question about particular experiences or experiences from everyday driving, which makes the riders to participate as they can engage actively in the seminar and feel seriously involved. Goal of this phase is to make the driver ready to learn.

Since most drivers have little or no experience with simulator rides, an intensive and caring support of the driver before, during and after the rides is required.

- Before the ride:
Here it is important to still the (latent) fear about the new technical media arising among participants. It is also often a fear to embarrass them because they are not familiar with all functions of the simulator or the driving tasks.
- While driving:
 - Especially during the initial stages of the simulator operations from time to time small technical problems occur, because there are deviations from the usual vehicle. By supporting and short notes you can help the drivers to a desired safety in dealing with the system.
 - In a few cases, a slight discomfort occurs for a few drivers. This needs a quick reaction, e.g. by shortening the journey time. Therefore, as a trainer a good observation of the driver is essential. Already during the ride or directly after ending it, the driver and all other students should be informed that there are differences between driving simulation and real vehicle and usually after a short adaptation most drivers overcome the discomfort.
- After the ride:
 - Positive behaviours shown on the familiarization ride (quiet driving, comply with the requirements of speed,) should be highlighted and serve as a guideline for the expected behaviour to the other participants.
 - Especially if a student feels unwell, a positive valuation of the experience should help to continue to participate at the seminar and get the chance of making more trips.

A later change of behaviour requires the critical discussion of the subject, such as EcoDriving. Drivers must therefore be encouraged to deal critically with the impact of individual driving behaviour. The trainer needs to explain the facts about the impact of fuel consumption as well as the technical influences of the driver by using the possibilities of the vehicle. The central question is: "What can I do as a driver to drive more economically." Most drivers have experience in this that is important to follow. At this stage, the link to simple rules can be carried out such as the "golden rules". Good solutions for changing behaviour are in the best case developed individually for each driver in order to let everyone know how he must change his individual style to achieve the desired effect.

During a simulator ride different behavioural strategies can be practiced by the participants. The trainer has to pick up the correct behaviour and strengthen it. By multiple repetitions and practicing the changed behaviours it can be achieved, that the driver develops a medium- and long-term modified driving style that, for example considers the aspects of the EcoDriving and leads to lower fuel consumption.

As a continuation of the strategies developed in the previous phases, to change the behaviour of every driver an individual influence must be developed. For each driver other changes are crucial on how to implement a personal "EcoDriving". Here an individual solution can be developed only through analysis by the trainer and joint evaluation of the results with the driver.

In addition to the individual measures and rules, the focus of the training is to demonstrate general ways of changing the behaviour. By this the driver can represent the relevance and importance of the topic as a multiplier in his company and support a long-term acceptance of the changed behaviours.

The medium- and long-term implementation of the learned will only be achieved if the trainer creates a motivation for implementing the learned by the driver. In addition to the personal motivation of the driver it is helpful to have a coordinated campaign or evaluation possibility within the company.

6 Expected results

At the end of a seminar there are statements and opinions caused by the active participation of the participants in the seminar, how and in what form they can implement EcoDriving in their operational practice. These statements can be summarized in the form of key messages and held transparently for all at the end of the seminar and handed over if necessary.

The possibilities of change, worked out individually with each participant in the simulator ride, should be addressed even once more specifically and the driver can take this as their phrase.

It can generally be expected, that beyond the individual approach, participants have a general understanding of the possibilities of influencing EcoDriving.

It cannot be expected however, that a long-lasting and sustainable change in behaviour can be reached after a one-day and single seminar on EcoDriving. As with all exercised behaviours a permanent change in behaviour can only be expected after repeatedly and correcting measures. The goal is not to achieve an impressive success at the end of a training day, but the long-term behaviour change. Just through the use of a simulator a variety of driving and everyday situations can again and again be an experience to support the process of a sustainable change.

7 Train the trainer Seminars

As with almost all (new) methods, the qualification of the trainers is an important cornerstone for successful use of the method. The same applies to a sophisticated technical and didactic system such as a bus simulator. A short technical briefing just once is enough, to get familiar with the general functioning of the simulator. Like described above, in order to be fit for an actively and purposefully use in a seminar, a detailed engagement is required. Therefore it makes sense to participate at several hands-on workshops, where the trainer as well as the later participants, learn about the capabilities and applications of the simulator. At the same time, as the development of the trainers personal skills on secure handling the Simulator, the methodological and didactic forms of usage and fields of application can be developed. Therefore, practical cases should be edited, whose functionality can be tested on the simulator. Here, it is useful when several coaches are trained, who can introduce the concepts each other and together test the effectiveness and make necessary adaptations.

Overall a total of approximately 8-10 training days, distributed over 3 to 4 multi-day meetings with intermediate phases of self-learning are a good basis for a well-educated trainer who can integrate a simulator in seminars. "Train the trainer" seminars should be attended there, where a proven training experience exists.