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ROAD SAFETY IMPROVEMENT IN LARGE COMPANIES. AN EXPERIMENTAL COMPARISON OF DIFFERENT MEASURES

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Abstract—Road accidents among professional drivers are a major problem in many companies. There are several traditional measures for improving safety, but knowledge about what measures are most effective is rather limited. The aim of the study is to compare four different measures for reducing accident involvement through changed driver behaviour. The measures are driver training, group discussions, campaigns and bonuses for accident free driving. Five groups of approximately 900 drivers each employed by the Swedish telephone company “Televerket” have been used in the experiment. Four of the groups were test groups, where each took part in one of the measures. The fifth group was a control group. The effect on accident risk (accidents in relation to mileage) and accident costs have been calculated for a period of 2 years after the measures were applied. The results show that group discussions and driver training with the rather unusual design used in the experiment succeeded in improving the accident risk compared to the control group. Accident costs were reduced in all four test groups, but not in the control group. Copyright © 1996 Elsevier Science Ltd

Keywords—Traffic safety, Driver training, Occupation (work), Improvement, Driver, Behaviour, Accident, Cost, Reduction

1. INTRODUCTION

In many companies, road safety is a major problem with regard to personal injuries as well as costs. This problem is obviously larger in companies where the use of cars and the need for road transport is large. In such companies, road safety may in fact be one of the most important working environmental hazards. In the Swedish telephone company, “Televerket”, the company studied here, all 10 deaths in occupational accidents during the last 8 years were road accidents.

Several measures have been used to improve occupational road safety, such as vehicle improvements, better working environment in the car, driver training, local campaigns etc. Despite many efforts to prevent traffic accidents, however, the road safety problem remains. There is also considerable uncertainty about the effects of many educational and behaviour oriented countermeasures.

It is a well known fact that in spite of all the technical improvements to cars and roads, it is still the driver who is expected to make use of the improve-

ments and the possibilities of achieving better safety. These improvements must therefore be combined with psychological or educational measures that make the driver realize the benefit of safe driving.

The best way to do this, however, is not very obvious. Traditionally, we choose between driver training and information campaigns, but we do not really know which is the best choice. Below, four different measures will be described: driver training, road safety campaigns, group discussion methods and bonus systems for accident-free driving. The aim in this introductory description is not to give a complete review of the literature, but rather to present the background for the measures chosen in the experiment to be presented later in the paper.

Driver training

Traditional driver training has not yet lived up to what has been expected of it. The common sense assumption is that the more skilled a driver is, the safer he will be. This is why driver training often focuses on skill improvement. Much effort is put into teaching the driver to react adequately in critical situations. Thus, training courses have been concerned

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with braking techniques, braking avoidance or handling a skidding car. However, there is now considerable evidence that such methods seldom lead to measurable improvements in safety. Many evaluation studies have failed to prove any safety effects of such training measures (see Gregersen 1991; Lund and Williams 1985; Lynam and Twisk 1995 for overviews). This may be due to methodological weakness in evaluation designs, but it may also be explained by aspects of the training as such.

A variety of explanations as to why driver training often fails to improve safety have been suggested. A common feature of these explanations is the concept of behavioural adaptation (OECD 1990). That is, the drivers make use of their improved driving skill not only for improved safety but also for purposes other than those intended.

This explanation suggests that the driver does not experience any need for improved safety. For the individual driver, the probability of being involved in an accident is very low and hence the driver is not aware of the need for improved safety. Thus, the advantages gained in driver training, such as improved skill, are often used not to improve safety, but rather to achieve other goals such as mobility, pleasure, adventurousness, fulfilling role expectations and living up to social norms etc. That is, motives that lead to immediate reinforcement for the driver (Näätänen and Summala 1976).

Another explanation is that the learner driver overestimates the safety effects of a training programme. He or she believes that it is possible to make use of what has been learned even if this may not be the case in real traffic. The relation between educational strategy and overestimation has been shown in an experiment by Gregersen (1995). In this experiment, learner drivers with trained skills were found to overestimate their ability more than learner drivers who were trained to realize their own limitations in the same situation. There was however, no difference in actual skill.

If these assumptions are valid and we still want to rely on driver training, the training must be carried out with some alternative strategy, such as providing insight into the driver's own limitations, making him or her realize that a high level of skill may not help in every situation, to convince the driver that secondary motives such as economy or protecting the environment are important for the company, society and the driver. Such secondary motives may lead to a safer driving style even in the absence of an explicit safety motive.

Campaigns

Researchers are usually negative to general campaigns directed towards large groups of drivers or towards society as a whole. Such campaigns have

rarely proved effective. It may be possible, however, to use campaigning in other ways that increase the probability of safety effects. Elliot (1989) has described several important aspects of the campaigning process. One of Elliot's more practical suggestions is to define carefully the safety problems that should be dealt with and to define priorities among these problems. Another important part is the definition of the target group and the best way to reach them. In large companies there are several specific problems that may be focused upon. These could be defined either through accident analysis or by discussion among drivers. There are seasonal problems such as low friction roads and darkness, and there are problems related to the working tasks, such as driving in confined spaces or loading goods and tools. By focusing on such specific and well known problems and by concentrating on small, local groups of drivers, the probability of success may be increased.

Group discussions about road safety

A method for behavioural change that is not very commonly used in road safety work comprises group discussions and group decision techniques. The method was introduced by Lewin (1947a) who showed that the method could be used to change eating habits in American families as well as productivity among factory workers (Lewin 1947b). In the area of road safety, the method was used in Japan in a study of bus drivers (Misumi 1978) which showed that accident involvement decreased sharply following group discussions. The study was repeated later with equally good results. Similar techniques were also found to reduce accidents in a shipyard (Misumi 1982). The method has also been described by Brehmer et al. (1991).

The strategy used by Misumi in his study of 45 bus drivers with high accident involvement was a process of 6 steps as follows:

1. A 60-minute warming up period, designed to ease tension among the participants.
2. Split up into four groups. A 40-minute discussion to identify problems at their workplaces.
3. A 20-minute meeting in the large group where the results of step 2 were reported. A list of 10 items was produced.
4. Each small group discussed which problems could be solved by themselves and which problems the company should try to solve.
5. The results were reported in the large group.
6. Discussions in small groups about measures and changes in driver behaviour. Each driver was told "Please write down on this piece of

paper what you yourself have determined to practice from tomorrow on. You do not have to show this to other people. Just keep it in your pocket. This is to help you remember what you have promised yourself to do. You can throw it in the waste-basket tomorrow if you feel you do not need it." (Misumi 1978).

There is a considerable number of studies showing that group decision techniques are effective. One example where group methods have been successfully used is in the health improvement area, e.g. among schoolchildren to improve health behaviour (Arborelius and Bremberg 1988).

Bonus for accident-free driving

There are several possible ways of rewarding drivers for accident-free driving. Experience in terms of evaluated effects on accident involvement is rather limited. Different bonus systems are frequently used by insurance companies in combination with car insurance where drivers are given a reduction in their insurance premiums if they drive without being involved in accidents. Such a system cannot be used among occupational drivers in a company since they do not pay any premiums or other costs that could be reduced. Instead, such drivers must be rewarded in some other way. The most obvious way is to be paid in money that the driver may use as he wants.

A way of combining individual gain with the important effect of social norms (Ajzen and Fishbein 1980) is to make groups of drivers earn the bonus together. The driver should then feel a responsibility not only towards himself and the company, but also

towards his fellow drivers. The fewer the accidents in the group, the larger the reward to be gained.

AIMS

As discussed above, it is not obvious which measure for increasing safety will be most effective. Since the costs of these measures may be high, it is very important for a large company with many drivers and high accident costs to invest in the right choice of measure.

The aim of this experiment is to compare the effects of four different road safety measures, driver training, campaigning, group discussions and bonuses. The purpose is to compare the methods with regard to accident reduction and cost reduction.

The hypothesis that is tested states that a measure is better than no measure at all (the control group). The accident risk and the accident cost will thus decrease more in the tested experimental group than in the control group.

MATERIALS AND METHODS

The study was carried out within the Swedish telephone company, Televerket. Of the 40,000 employees, about 15,000 are drivers. The company is organized in 20 districts with a total of 600 working units. Each working unit has a varying number of drivers, from 0 up to 250.

The design of the study was experimental with four different test groups and one control group. Each of the test groups carried out one of the four road safety measures. The control group did not participate

Fig. 1. Design of the experiment.

Fig. 2. Distributions of background data for the five groups: accidents per vehicle, accidents per driver, driver employment time and driver age

in the measures and did not know that it served as a control group (Fig. 1).

The size of the samples was calculated to give an 80% probability of detecting a 30% reduction in the accident risk (accidents per mileage). By using retrospective data on accidents in the company during the years 1983–1985, the sample size was set to 900 drivers. Since the measures demanded some form of organizational structure, it was impossible to choose individual drivers throughout the company. The working units were used instead. The average size of the working units was 30 drivers, which means that 30 working units were needed in each experimental group to achieve groups with 900 drivers in each group. The control group was equally large.

It was also necessary to combine several working units into larger groups geographically to make it possible to handle all the practical and organizational matters connected with the measures. Thus, instead of drawing the working units randomly, they were chosen to be as similar as possible by matching the

variables of earlier accident involvement, number of drivers and driving environment (rural–urban). Figure 2 shows the distribution of accidents/vehicle, driver employment time and driver age in the five groups. There were no obvious differences between the groups.

The sizes of the five samples are presented in Table 1. These are the number of drivers in the working units that were chosen. It is, however, possible that some of these drivers did not participate in the activities. It was impossible to make a correct calculation of dropouts caused by illness, working situation, organizational changes etc., but the number was estimated at about 10% in the driver training, group discussion and bonus groups and approximately 20% in the campaign group. In addition, there was a fairly large, unknown number of drivers who did not participate in all the five meetings of the campaign group. Since the results have been calculated by using each group's total number of accidents, mileage and costs the number of drivers participating in the measures are not directly included in the calculations.

The content of the measures

Based on the discussions presented above, the following measures for each measure were chosen.

Driver training

The training comprised three blocks, manoeuvring, skid training and "commentary driv-

Table 1. Sample size of the five groups

Groups	Drivers
Driver training	936
Campaign	915
Group discussion	917
Bonus	900
Control	988

Fig. 3. Skid simulator "Skid Car" used in the driver training.

ing". The manoeuvring and commentary driving parts were carried out in company cars. For skid training, the "Skid Car" (Cedergrens 1991) equipment for skid simulation was used (Fig. 3). Each of the blocks lasted $2\frac{1}{2}$ hours. The whole training programme thus lasted $7\frac{1}{2}$ –8 hours.

A special driver training team from the National Society for Road Safety (NTF) provided the instructors for all the drivers. The drivers also received help from Televerket drivers who were trained for the occasion.

The aim of the manoeuvring part was to familiarize the driver with his car and thereby reduce the damage to the car from unskilled manoeuvring in narrow passages etc. Driving was carried out at very low speeds and did not include any techniques for handling critical situations in normal driving.

The skid training consisted of two parts. The aim of the first part was to provide some basic knowledge about handling specific situations on icy roads. The second part focused on making the driver respect icy roads and making him realize that situations may well occur on the road that he cannot handle, i.e. he gains some insight into his own limitations.

The aim of the commentary driving (see

Gregersen 1994 for a description of the method) was to improve the driver's perception and interpretation of events during driving. Earlier findings (Spolander 1990) have shown that commentary driving influences driving behaviour measured as better speed adjustment, better scanning behaviour, etc. The training was carried out in real traffic. During the commentary driving part, two extra types of practice were included. One was to make the driver realize his own stopping distance. For this purpose, a special stopping distance meter was used. The other was to show the driver how different driving style influences fuel consumption. This was demonstrated by using a fuel consumption meter in the car.

Campaign

The campaign was designed to cover a number of road safety aspects regarded as especially important for company drivers. The information was given on five different occasions during 1 year. Each occasion covered specific seasonal problems.

The aim of the first meeting was to introduce the safety work and to motivate the drivers to be interested in the measure. The second meeting took place during the autumn and covered driving in darkness, stopping distances and warning for the first

ice on the road. The specific winter problems were covered during the third meeting, which included low friction, tyres etc. The spring meeting included aspects of unprotected road users, as well as a number of company specific problems such as loading tools and equipment. On the fifth and last occasion, the content of the other four meetings was summarized and discussed.

The information was given by specially trained employees from within the company. The information was given in groups during working hours. A number of video films with road safety themes were shown and campaign material and pamphlets were handed out to the drivers. Some of the video films were produced for this purpose.

Group discussions

The Misumi trials described above have formed the base for the Televerket design of the group discussion. Each driver participated in three meetings of small groups of 8–15 drivers, discussing problems of road safety and what to do about them. The three meetings correspond to sessions 1 + 2, 4 and 6 in the Misumi-design described above. Each meeting lasted approximately 1 hour.

The discussions were led by drivers from their own working unit who had attended a special introduction course. Thus the leader was one of the group who was able to share the experiences and the suggestions in a more natural way.

The company had agreed to do their best to meet the suggestions from the drivers about measures that should be activated by the company (a detailed discussion of the group discussion technique is given in Brehmer et al. 1991).

Bonus

Due to Swedish taxation rules etc., it was difficult to find a way of avoiding excessive taxation of individual rewards. Another solution had to be found. It was also decided that the group based measure would have other potential advantages as discussed above. The strategy chosen for the experiment was thus a group based measure. The details are presented below.

A reward system was chosen that included the whole working unit. From the start, the group was given a money level based on the number of vehicles (SEK 200 per vehicle). An average group with 30 cars started with SEK 6000. For each accident caused by a driver in the group, the amount of money was reduced by SEK 100 or 200 depending on seriousness. After 1 year, the remaining money was given to the drivers for a group activity such as a party, a pleasure trip or buying something together such as physical training equipment.

The bonus system was introduced to the drivers at an introductory meeting where the rules and the amounts of money were detailed. No follow-up information was given.

Evaluation methods

The effects of the four measures were evaluated in terms of accident risk and accident costs. Only those accidents that were caused by a company driver have been used.

Accident risk was calculated as accidents in relation to mileage, 2 years before and 2 years after the measures. Accidents were normally registered in the working units of the company and saved in manual files. These accidents were also registered on a special form developed in the project. Mileage was also normally registered in computerized form for each car, which made these data easily available. The same register included information about the number of drivers, number of cars and costs of accidents. Additional information about accident costs was collected from the register kept by the insurance company.

No reliable data could be obtained about the seriousness of the accidents other than the level of costs. This was due to existing routines for accident registrations in the company. The only data that were registered about accidents were the number of accidents and the level of costs. The costs have therefore been interpreted as a measure of accident seriousness. The costs included company and insurance company costs.

A questionnaire study was also carried out with all the participating drivers. However these results are not presented here. They are referred to only in the discussion (Gregersen and Morén 1990).

Statistics

Accident risk has been calculated as accidents per 10,000 km for each working unit.

Differences between groups and changes from before to after the measure have been tested with 95% confidence intervals for the risk ratio of the two risks to be compared.

Two types of comparison have been made, before and after in each group and between groups after the measures.

RESULTS

Accident risk

The development of the accident risk in the five groups is shown in Fig. 4.

The statistical tests show reductions of accident risk in three of the four groups, driver training, group discussions and bonus. It appears that the driver

Fig. 4. Accident risk before and after the measures in the five groups. The time t_0 is when the groups were selected and the measures were started. Time t_{-1} shows 2 years of retrospective data that were used to match the groups with respect to earlier accident risk. The 2 years after the measures are indicated by t_1 .

training and the group discussions gave the largest reduction, followed by the bonus. No reduction was found in the campaign group or in the control group. The between groups comparison of the risk after the measures (t_1) shows a similar pattern. However, the first comparison, within groups, is the most interesting, since it takes into account the small differences in accident risk at time t_0 . The confidence intervals of the risk ratio calculations are shown in Table 2.

Accident costs

Accident cost was calculated for accidents where a company driver partly or completely caused the accident. This is the only accidents where the company actually had any costs, directly or through the insurance company. The figures were collected from Televerket and the insurance company. Together, these data describe the total monetary accident cost. No other types of costs, such as human suffering or loss of working time or costs for society, have been included.

The development in accident costs has been described in Fig. 5. The results show a decrease in

costs in all experimental groups. The group discussion measure is outstanding in regard to cost reduction. The costs were reduced from about SEK 800/10,000 km before to SEK 300/10,000 km after.

DISCUSSION

The results show that it was possible to reduce the accident risk as well as the accident cost among the professional drivers in a fairly large organization, such as the Swedish telephone company.

In a large experiment such as this, there are always problems due to changes in the organization. Geographical responsibility for working units and the vehicle fleet changes, drivers leave the company and new drivers are recruited, people change duties etc. This has also been the case in this experiment. There were several small organizational changes where people changed working units etc. and these changes were impossible to check. Some of them could be detected in time and sometimes it was also possible to prevent such changes from influencing the experi-

Table 2. Confidence intervals for the risk ratio calculations within groups and between groups

Groups used for the comparison	Lower limit	Risk ratio	Upper limit	Significance
Driver training (within)	1.35	1.67	2.17	yes
Group discussions (within)	1.77	2.26	3.10	yes
Campaign (within)	0.68	0.82	1.02	no
Bonus (within)	1.10	1.31	1.64	yes
Control/Driver training (between)	1.25	1.59	2.18	yes
Control/Group discuss (between)	1.37	1.79	2.59	yes
Control/Campaign (between)	0.60	0.75	1.04	no
Control/Bonus (between)	1.08	1.35	1.79	yes

Fig. 5. Accident costs before and after the measures in the five groups. The time t_0 is when the groups were selected and the measures were started. Time t_{-1} shows 2 years of retrospective data that were used to match the groups with respect to earlier accident risk. The 2 years after the measures are indicated by t_1 .

ment, but certainly not in every case. The drivers involved in such changes have been included in the proportion of dropouts, which was estimated at 10–20%.

Due to these changes, the groups differ with respect to background data compared to the time when the samples were drawn. This is the reason why the accident risk in Fig. 3 before and at the starting point is not equal in every group. The most obvious difference is the higher accident risk before measures among those involved in the group discussions. Their initial risk may thus contribute to some degree of regression effect, since they start from a higher level. The probability of accident reduction is higher if the initial level of risk is higher. If this is the case, the reduction in this group may to some extent be explained by chance or by a diminishing trend. There are also some dissimilarities between the other groups, but they are fairly small and there is no reason to believe that these changes jeopardize the interpretation of the results.

The overall purpose of the study was to compare the four measures with respect to their effectiveness in reducing accident risk and costs. The results show that two of the measures are better than the others: the group discussion and the special form of driver training used here. The results of group discussions also support the findings of Misumi discussed above. The second measure was driver training with its special content. The bonus system was also successful, but not as good as the first two measures. Campaigning was not successful in reducing the accident risk, but there was nevertheless a reduction of accident costs also in this group. The results from the campaign group thus suggest that the accidents became less serious after the measure.

It is difficult to make a cost benefit analysis of the measures. Naturally, each of the measures also means costs for the company. The most expensive

measure was driver training, which demanded the use of cars and equipment as well as external instructors moving to a number of driving ranges all over the country to train all the working units involved. The cheapest method was probably the group discussion, which demands nothing other than the participation of drivers and training of the group leaders.

The positive results of the driver training do not support the general international results of short training programmes. Many such evaluations have failed to show effects or have even shown increased accident involvement. The purpose of this specific design of the driver training was to use new approaches to some of the specific problems discussed in the Introduction which means that we believed in a better result than in many other studies. This was also achieved. The level of accident reduction was very high which to some extent was unexpected. The most probable explanation is the purpose and the content of the training. Specifically, the aim was not primarily to increase the drivers' skill in manoeuvring the car, but to create insight about risks in traffic and about the drivers' own limitations.

Another aspect that may have contributed was that of realizing how driving style influences fuel consumption. For many drivers, the well-being of the company also means job security. Reduction of costs may have been seen as a means to increase the probability of keeping a good job. The training may thus make the driver realize the relation between driving style and costs. From a safety point of view, it is probable that a driving style that reduces fuel consumption also reduces the probability of accident involvement.

The driver was expected to become more careful and foreseeing, which according to the theories of risk compensation and of overestimation of his own skill, presented above, is more likely to reduce accident involvement than training of skills that may be

used for other motives such as mobility, pleasure etc. We do not claim that the results prove there is any difference between two basically different strategies for training since the present alternative has not been compared with the traditional method in this study. It may, however, serve as an inspiration to develop such training strategies further in combination with making scientifically correct evaluations.

The reduction in accident risk as a consequence of group discussion supports the earlier findings of Misumi. Also with this measure the level of accident reduction was very high. There may be several explanations for this. One could be that the measures actually taken by the company based on the suggestions by the groups were effective. This does not seem to be the most important explanation, since in the questionnaire sent out to all drivers as part of the evaluation, they reported that many of their suggestions had not been acted upon (Gregersen and Morén 1990).

Lewin's theory, which forms the basis for this intervention, attributes the effect to the fact that the drivers have made a personal decision. Lewin saw the decision as the cement that joined intention and action, and without a decision, changes in intentions that may well result from information campaigns for example, will not affect safety because the intentions have not been linked with the drivers' behaviour.

However, the group discussion intervention was a complex one, and in addition to the possible effects of having made a personal decision, it should be noted that the discussions served to make the group norms more explicit. Following Ajzen and Fishbein (1980) in their theory of reasoned action, this will have important effects on the subjects' behavioural intentions, creating intentions that are positive with respect to safe driving. When these intentions are also linked with behaviour by means of personal decisions, positive effects on safety would follow.

Moreover, the discussions are likely to have served as an important means of exchanging information about possible dangers and ways of avoiding them in traffic. Without the group discussions, such information exchange might not have taken place.

All these factors may contribute to the effect of the group discussion intervention, and it is not possible to draw any definite conclusions about the reasons for the effect without further research that seeks to disentangle the effects of the various factors.

The accident reduction in the bonus group was not as large as that in the other two groups. There was, however, a reduction, which makes the bonus system a measure that may be used for increased safety. It is not very expensive to organize and it

gives the drivers positive feedback and a feeling of concern on the part of the company. The level of reduction indicates, however, that the bonus system could be made more effective. There were also complaints put forward in the questionnaire study (Gregersen and Morén 1990) among the drivers that the level of reward was too low. With only a few vehicles in a group, the remaining money could be too little to use for anything meaningful. Limited interest in the reward was also reported, since the system was very seldom discussed or even thought about among the drivers. These opinions indicate that a more attractive design of the bonus system should be developed.

The campaigns did not succeed at all in reducing accident risk. The results are, however, contradictory since the accident costs decreased after the campaign period. A possible interpretation of these differences is that the accidents were less serious. There are also results concerning the type of accidents, indicating that there were more single accidents and fewer collisions after the measure (Gregersen and Morén 1990).

With a campaign of this type, some effect on accident risk should be expected. It was a very local campaign, applied to small groups with common interests and a common working situation. The themes of the campaign were developed to link up with problems and working situations that could be identified by the drivers and the material was to a large extent developed within the company. The instructors were fairly well known and were chosen from inside the company.

There are two probable types of explanation. One is that there was a deficiency in the design and content of the campaign. Elliot (1989) suggests that campaigning may prove to be more effective when combined with other types of measures such as changes in the law. Another explanation was revealed by the questionnaire study. We found that many of the drivers did not participate in all the five meetings. The exact number cannot be calculated. If participation in the meetings was encouraged more and also better checked, the results could have been better (Gregersen and Morén 1990).

It is, however, important to underline that problems such as limited participation etc. are normal occurrences in measures such as those tested in the experiment.

CONCLUSIONS

The conclusion from the study is that driver training and group discussions are methods that can probably be recommended for use within large companies. These are measures that have been shown to

reduce both accident risk and accident costs. This has also been recommended to the Swedish Televerket for general use throughout the company. However, it is important to follow the steps of the group discussions and the goals and content of the driver training as described in this study. There are certainly other ways of designing group decision methods or driver training that also may be successful, but our recommendations can only include the methods that we have used. It is also possible that these measures may prove even more effective if they are combined, but our comparisons do not allow any such conclusions. The company have introduced the group discussion measure throughout the company but the results of the discussions in terms of safety and costs have not been evaluated.

The results from the experiment also indicate the need for further research. The group decision method is fairly new in road safety work and should therefore be developed further.

The results may also be interesting for other groups of drivers. The results were achieved among professional drivers in a large company, but there are several groups where it is urgent to reduce the accident risk. One of the most accident prone groups of drivers consists of young, novice drivers. A major part of the safety work directed towards them includes driver training and thus it may be interesting to develop and adjust the driver training strategy of this study in training of young drivers. A similar type of training has been used as a part of a more comprehensive training programme of young learner drivers in an experiment by Gregersen (1994). The results from this study showed a delayed effect on accident risk.

The group discussion technique may also prove effective among other high risk groups, such as young drivers or subgroups of young drivers. They are in a situation where the liberation process and the subjective norms are important, and thus influence intentions and behaviour (Gregersen and Bjurulf 1994). The group method may serve to make the group norms more visible, which may create intentions that are more positive with respect to safe driving. Through the personal decision, these intentions may be linked with behaviour. It is therefore suggested that the group discussion method be tested among young drivers.

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REFERENCES

- Ajzen, I.; Fishbein, M. Understanding attitudes and predicting social behaviour. Englewood Cliffs, NJ: Prentice Hall; 1980.
- Arborelius, E.; Bremberg, S. "It is *your* decision!" Behavioural effects of a student-centred health education model at school for adolescents. *J. Adolesc.* 11: 287–297; 1988.
- Brehmer, B.; Gregersen, N. P.; Moren, B. Group methods in safety work. Uppsala: Department of Psychology, University of Uppsala; 1991. In preparation.
- Cedergrens. Skid Car—Learn today, and live tomorrow! Information material. Klintehamn: Cedergrens i Klintehamn AB; 1991.
- Elliot, B. Effective road safety campaigns: A practical handbook. CR80. South Australian Department of Transport; 1989.
- Gregersen, N. P. Young drivers. Safety problems and effects of educational measures (in Swedish). VTI Rapport 368. Linköping: Swedish Road and Transport Research Institute; 1991.
- Gregersen, N. P. Systematic co-operation between driving schools and parents in driver education, an experiment. *Accid. Anal. Prev.* 26: 453–461; 1994.
- Gregersen, N. P. Young drivers' overestimation of their own skill—An experiment on the relation between training strategy and skill. *Accid. Anal. Prev.* 28: 243–250; 1996.
- Gregersen, N. P.; Morén, B. Road safety measures in the Swedish Telecommunication administration. A comparative study on reducing accidents and costs with driver training, group discussions, bonus and campaign. (In Swedish). VTI Rapport 348. Linköping: Swedish Road and Transport Research Institute; 1990.
- Gregersen, N. P.; Bjurulf, P. Young novice drivers: Towards a model of their accident involvement. *Accid. Anal. Prev.* 28: 229–241; 1996.
- Lewin, K. Group decision and social change. In: *Readings in social psychology*. Newcomb, T. M.; Hartley, E. L. (Eds). New York: Holt, Rinehart and Winston; 1947a.
- Lewin, K. Frontiers in group dynamics. Concepts, method and reality in social science; social equilibria and social change. *Human Relations* 1: 5–38; 1947b.
- Lund, A. K.; Williams, A. F. A review of the literature evaluating the Defensive Driving Course. *Accid. Anal. Prev.* 17: 449–460; 1985.
- Lynam, D.; Twisk, D. Car driver training and licensing systems in Europe. TRL Report 147. Crowthorne, Berks., U.K.: Transport Research Laboratory; 1995.
- Misumi, J. The effects of organisational climate variables, particularly leadership variables and group decisions on accident prevention. Munich: Paper presented at the 19th International Congress of Applied Psychology; 1978.
- Misumi, J. Action research on group decision making and organisation development. In: *Social Psychology*. Hiebsch, H.; Brandstätter, H.; Kelley, H. H. (Eds). Berlin: VEB Deutscher Verlag der Wissenschaften; 1982.
- Näätänen, R.; Summala, H. Road user behaviour and traffic accidents. Amsterdam: North Holland/American Elsevier; 1976.
- OECD. Behavioural adaptations to changes in the road transport system. Paris: OECD; 1990.
- Spolander, K. Effects of commentary driving—A study on young male drivers. VTI Rapport 359. Linköping: Swedish Road and Transport Research Institute; 1990.

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