



REPORT FROM THE ADVISORY GROUP

# The Norwegian Council for Road Safety's model for behaviour modification

*A model for quality assurance and evaluation of programmes in the efforts to promote traffic safety*

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**TRYGG TRAFIKK**

## PREFACE

The Norwegian Council for Road Safety sees a need for obtaining more knowledge about training programmes that produce an impact in the short and long term. We have some knowledge about the effect of campaigns, for example through the EU project CAST. However, we have less knowledge about the effect of training programmes in schools and day-care centres. As a rule, training programmes take time, and it is difficult to isolate the effect of training from other influences to which children and adolescents are exposed.

The Norwegian Council for Road Safety seeks expert advice associated with evaluation and quality assurance of programmes. This applies to programmes to be undertaken by the Norwegian Council of Road Safety as well as those implemented by educators and other staff in schools and day-care centres. In addition, we need an adequate basis for setting priorities in communication with the educational system at all levels. Updated knowledge should form the basis for development of material and programmes for day-care centres, schools and teacher training colleges.

To respond to these issues and provide recommendations for the associated efforts, the Norwegian Council for Road Safety established an advisory group in the spring of 2015. The group includes three external and three internal members. The external members are researchers in the areas of traffic safety and education and have experience in the application of qualitative as well as quantitative methods: Nils Petter Gregersen, Anders Isnes and Torkel Bjørnskau. The Norwegian Council for Road Safety is represented by Chief Advisor Tori Grytli, Senior Advisor Bård Morten Johansen, and Chief Training Officer Kristin Eli Strømme. The advisory group has been composed to achieve a broad approach that balances experiential and evidence-based knowledge. The advisory group recommends that project managers and heads of departments base their efforts on the academic input and discussions provided in the report. Having reviewed relevant research and prepared the Norwegian Council for Road Safety's model for behaviour modification, we can see that this work is relevant for training projects as well as other types of information work and campaigns.

Oslo, 2017  
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# INTRODUCTION

## MANDATE AND INTERPRETATION OF THE MANDATE

The mandate consisted of three items:

1. The Advisory Group shall review the evaluations that the Norwegian Council for Road Safety has undertaken over the last ten years, identify their strengths and weaknesses, point to challenges and identify needs for evaluation skills in the organisation.
2. The group shall discuss issues associated with evaluation of long-term preventive work and supplement the perspectives in the evaluations undertaken by the Norwegian Council for Road Safety.
3. The group shall submit recommendations regarding the best possible organisation of evaluation work in the Norwegian Council for Road Safety.

The Advisory Group has interpreted its mandate as including not only evaluation of programmes, but also the planning of these. The group believes that evaluation cannot be seen in isolation from planning and implementation of projects. The group has been granted access to a number of research reports, mappings and documentation of evaluation work undertaken by the NCRS over the last ten years. Many of the members have previously been actively involved in parts of the evaluation work. The group has focused on providing advice for future efforts. Issues that we have discussed include the following:

- Training programmes often have a long-term perspective, but tend to be assessed over a shorter time.
- Measuring the impact of a single training programme is difficult, because both those who are exposed to it and the control group are under the

influence of a number of other factors in parallel, including through the media, their families, schools and traffic education programmes.

- When measuring attitudes before and after interventions, it often turns out that most adolescents have appropriate attitudes and behaviour, complicating any demonstration of progress.
- Knowledge is far easier to measure than attitudes and behaviour.

The NCRS members of the group have specified that the organisation's efforts mainly tend to go by way of other agents, and that the target groups for our programmes tend to be educators and other staff in day-care centres and schools. We have commented on and responded to questions regarding evaluations undertaken in recent years, and the group has thus been able to form a shared opinion of the organisation's efforts. Our main impression is that the NCRS takes this evaluation work seriously and can point to systematic efforts undertaken over many years. The researchers in the advisory group nevertheless wish to point out certain challenges and add some new perspectives to this work. In response to issues pertaining to the impact of long-term preventive work, the group has chosen to develop a separate model that shows the factors that can be influenced in attempts to modify behaviour. The model can be applied to training programmes as well as campaigns, information work and other activities.

A major part of the NCRS's work aims at influencing or changing people's behaviour to ensure that they behave in a safe manner. For this work to be effective we need to make use of knowledge and theories pertaining to traffic safety, behaviour modification, behaviour change and traffic psychology. A theory is useful in providing insight into how things

are correlated and showing how different factors interact. If we want to change people's behaviour or attitudes, we need to know what affects these and the ways in which behaviour and attitudes are related. Having a theoretical model, we know what an appropriate focus will be. Theories that are used in traffic safety promotion have a number of similarities, but also some differences. Each theory adds aspects that enhance our understanding of the determinants of human behaviour and thus points to approaches to and preconditions for effectively influencing this behaviour.

With the aid of analyses of five of the most recognised and applied theories of behaviour modification, we have developed a new, joint model that we believe will be suitable for the NCRS's work. Three of these five theories point to the association between different factors and behaviour, including intentions, attitudes, beliefs, various background factors and social aspects. These three theories share a number of structures. The result of the efforts represents an important part. Attitudes are emphasised as a type of result, but also as a component in the process of change. One of the theories describes intentions as a transitory stage before real behaviour change occurs.

On this basis, we have developed a joint model for behaviour modification, in which we have attempted to combine key aspects of all five theories. The model, which we have named The Norwegian Council for Road Safety's Model for Behaviour Modification (abbreviated MAP), will be a tool for optimal planning and implementation of programmes and for what can be evaluated. There is currently a positive trend with regard to traffic accidents, and many training programmes aim to exert influence in support of this trend. We therefore say that the NCRS's efforts, and its training activities in particular, aim to modify or influence people's behaviour.

### Report structure

In [Chapter 1](#), traffic safety promotion is placed in a larger context. Many factors in society will have an effect on transport needs and on our thinking with regard to transport and safety in the years to come, and these essential factors must be taken into account. We describe training as a component of traffic safety development.

In [Chapter 2](#), we present various models for behaviour change and the advisory group's model for

behaviour modification. This model will simplify the choice of approach in our programmes and raise the awareness of what we want to modify and how we seek to do it. We show how the model can be used as a planning tool, using a concrete example of safe use of bicycles.

In [Chapter 3](#), we review a number of educational models, with a main emphasis on the 5G model. This model shows how we can systematically facilitate more student-centred methods and give rise to more permanent learning outcomes, with evaluation as a consistent factor. We use the same example as in [Chapter 2](#) on bicycles, and continue by showing how the model can be applied to the design of educational programmes.

[Chapter 4](#) focuses on evaluation – of training programmes as well as more campaign-type interventions. You can read this chapter as a brief evaluation manual. Some may think it would be best to read this and the following chapter first, before turning to the models.

[Chapter 5](#) refers to best practices in the area of traffic safety and provides an account of our knowhow regarding what works and may produce positive effects. We highlight research results and discuss them. The material is structured by age, permitting you to easily find your area of interest.

[Chapter 6](#) summarises how the model can be applied in practice. First, we provide a general guidance template, followed by two examples: Children's Traffic Club and the use of reflectors by pedestrians. We have chosen these examples to show that the model is relevant for interventions that target long-term processes, such as training, as well as for interventions that produce a more immediate impact, such as information and campaigns.



## Chapter 1

# LOOKING AT TRAFFIC SAFETY PROMOTION

A White Paper on traffic safety was published in the autumn of 2016, Report No. 40 (2015–2016) to the Storting: Traffic Safety Promotion – Coordination and Organisation. The introduction says:

'Norway is the world leader in road traffic safety. In 2015, no other countries had a lower risk of death in road traffic measured in fatalities per million inhabitants.

In recent Norwegian history, the number of road traffic fatalities has never been as low as in 2015. However, this loss of life is nevertheless unacceptable. Norwegian promotion of traffic safety is long-term, broad and evidence-based. This long-term and targeted effort, including continuous development of new instruments and focus on measures that have a documented effect, has helped produce a considerable reduction in the number of injuries and fatalities on Norwegian roads. In 1970, a total of 560 people were killed in road traffic accidents. In 2017, this figure had fallen to 117, equal to an 80 per cent reduction in the number of annual fatalities and the lowest number since 1947, a time when the vehicle population was only 3.4 per cent of its current volume. With the same risk as in 1970 we would have had approximately 2 200 road traffic fatalities in 2015.

It is especially gratifying to see that the number of children under 15 years who perish in traffic accidents has been reduced from close to 100 each year in the 1970s to fewer than ten in recent years. Three children lost their lives in traffic in 2015. For this group, the Government's vision of zero fatalities or serious injuries in traffic – Vision Zero – is within reach.'

## TRAFFIC SAFETY IN A LONG-TERM, SUSTAINABLE PERSPECTIVE

Vision Zero has remained relatively unchanged in Norway since it was first adopted in 2002. Since then, society and transport policy have undergone major changes, and we can envisage that further major changes will come in the near future. The requirements for a long-term sustainable transport system is increasing, including concerns for the climate and environment, economic efficiency and social welfare. The need for transport of people and goods will increase in Norway and internationally. This will involve major requirements for infrastructure and collaboration between transport industries as well as between countries. The Norwegian effort to promote traffic safety needs to be refined to accommodate this development.

In the years ahead, cars will gradually be replaced by self-driving vehicles. The development of new urban and residential areas aims to prioritise public transport and focus more on cyclists and pedestrians. In the long term, this may produce a society with less frequent traffic accidents. In a political perspective, we may not regard traffic safety as a prioritised area. Because there is already a wealth of established knowledge concerning the design of infrastructure while car manufacturers invest heavily in vehicle safety, other societal goals that compete with traffic safety may be given higher priority, not least in a situation where the number of injuries and fatalities is at a record low level.

The EU strategy document for traffic safety 'Towards a European traffic safety area: policy orientations on road safety 2011–2020' describes this as follows:

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### An integrated approach to road safety

The future road safety policy should be taken into account in other policy fields of the EU, and it should take the objectives of these other policies into account. Road safety has close links with policies on energy, environment, employment, education, youth, public health, research, innovation and technology, justice, insurance, trade and foreign affairs, among others.

In a sustainable transport system, road safety will have to be regarded in the context of the development of climate, energy, accessibility, equality, well-being and health qualities. Many of these areas are already incorporated in goals for transport policy, but instead of assuming a narrow perspective that focuses on each quality in isolation, we will most likely come to work in a broader perspective. This will set greater requirements for interaction between various competencies, sectors and stakeholders. We will therefore outline a few development trends that will affect the design of future transport systems and promotion of traffic safety.

### Urbanisation

In Norway, increasingly more people are likely to move to the major urban areas. Urbanisation will entail large demands on the transport system in terms of the transport options in the increasingly densely populated major cities as well as in rural areas. All traffic growth in urban areas should preferably come in the form of expanded public transport, cycling and walking. This will give rise to major challenges for traffic safety.

### Globalisation

Global changes in the economic structure with huge international trade volumes present the transport system with new requirements for transport of goods over long distances. A lot of the transport of goods goes by road, and increased trade will entail increased use of heavy trucks, which will entail a greater burden on the environment and climate and exacerbate traffic safety problems. Heavy vehicles are overrepresented in accidents that cause fatalities and serious injuries. Migration is another aspect of globalisation, and in the area of traffic safety, this will mean requirements for information and training.

### Energy consumption and environmental impact

The transport sector consumes large amounts of non-renewable energy resources and accounts for a large proportion of the emissions of climate gases

and local pollution. To reach the sustainable development goals, transport volumes must be restricted and made less dependent on oil as a fuel. We need to make provisions for promotion of public transport, cycling and walking, while ensuring traffic safety.

### More cyclists and pedestrians

Our goal is to increase the number of cyclists and pedestrians. This will lead to more accidents unless suitable measures are implemented. Infrastructure development is important, but probably not sufficient. Cars, buses and trams will still remain a risk to cyclists and pedestrians. Education and training will be required. Some new 'means of transport' have appeared in recent years. Electric bicycles and self-balancing vehicles are available in multiple versions and models. In Norway, we have not yet seen that these vehicles constitute an extra traffic hazard, but we know from the Netherlands, for example, that electric bicycles bring an added risk. As their frequency increases, it will be crucial to monitor developments to enable measures to be taken also in this area.

The Government's bicycle strategy, cf. Report No. 26 to the Storting, National Transport Plan 2014–2023, includes the objective that 80 per cent of all children and adolescents should walk or cycle to school. Safe bicycle lane networks is a key element in the facilitation, but bicycle training under the auspices of schools, parents and NGOs is also a key instrument to ensure safety for bicycles in traffic.

### Increased life expectancy and more elderly people

The demographic development points towards a continued increase in life expectancy. An ageing population will impose new requirements for the transport system in terms of accessibility, safety and security. The elderly are physically more vulnerable and thus more easily injured in traffic accidents. Vision Zero emphasises that the design of traffic safety measures should be dimensioned according to the weakest groups. A growing number of elderly people will entail a greater need for traffic safety measures for this group. In addition, technological development is accelerating, and many elderly people have a hard time keeping up. They need support and help to understand as well as to decide how to stay safe in traffic. Politicians and planners need knowledge about elderly people and their qualifications and opportunities to be mobile in a transport system guided by technology.

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### Technological development in the area of transport

In traffic we are gaining access to a growing number of technological support systems that can make travel more effective as well as cleaner and safer. The development towards automatic driving has been made a highly prioritised area in both politics and the car industry, and it is assumed that it will become a reality that enhances safety in the foreseeable future.

However, we also need to warn against a technological development that fails to take into account that humans are active, thinking agents that can adapt to technology in unforeseen ways. There is thus a possibility for an exaggerated belief in the ability of technical support systems to eliminate risk. The development of automatic vehicles involves a number of challenges, for example with regard to issues of responsibility, behaviour in mixed traffic, the transition from automatic to manual driving and the relationship to cyclists and pedestrians. As yet, we have insufficient knowledge of the requirements this will represent for the authorities as well as the road users.

### A SYSTEM PERSPECTIVE ON TRAFFIC SAFETY

Even if we succeed in developing cars, roads and traffic participants that each have a potential to avoid accidents and injuries, the entire system must be used in practice in a way that optimises its potential for safety. This includes, for example, ensuring that all those who are involved in designing and using the traffic system have sufficient knowledge and are motivated to act to optimise the level of traffic safety.

This means that general infrastructure and social planning must be undertaken with traffic safety as one of the manifold qualities we seek to achieve. Education of the road users should be regarded as a component in a system of measures that also includes legislation, speed limits, road design, technical support systems, monitoring and sanctions. Coordination of measures and collaboration between road users are thus key elements in promotion of traffic safety, because this produces synergies. Good collaboration is an important part of the explanation of why Norway is one of the safest countries in the world in terms of road traffic.

The model presented in Figure 1.1 on the next page

illustrates a system perspective presupposing that humans are not exposed to a force greater than the body can tolerate. By regarding traffic as a system in which safe users interact with safe cars and safe roads, we can achieve a safe use of the road traffic system, and thus fewer fatalities and injuries. Such a systemic approach also includes measures to ensure that those who fall victim to an accident receive correct treatment as quickly as possible. Rapid and adequate first aid, securing of the accident site and rehabilitation are therefore key components in a system perspective..

### EDUCATION TO REDUCE THE NUMBER OF TRAFFIC ACCIDENTS

Norwegian efforts to promote traffic safety are based on Vision Zero, meaning that nobody should be killed or seriously injured in traffic. A large proportion of the accidents occur because people make erroneous and risky decisions in traffic. The reasons might include lack of competence, poor attitudes, personality, lifestyle, group pressure or norms. The road users' behaviour has a large impact on traffic safety. If everybody observed the speed limits, wore a seat belt and did not drive while under the influence of alcohol or drugs, the number of fatalities could be halved. In addition to improvements in road environments and vehicle technology, we therefore need measures that can provide the road users with knowledge, understanding and motivation to make correct choices. Education and information campaigns are therefore essential.

The foundation of attitudes to traffic safety are laid in childhood, and it is thus crucial that traffic education starts early and continues through the school years. If we want more cyclists without increasing the number of accidents, more effort must be devoted to traffic education. The local councils are responsible for ensuring that schools and day-care centres maintain appropriate routines for traffic safety while the children are out on foot, in a car or in a bus. All local councils should make sure that day-care centres and schools provide quality traffic education with an appropriate rate of progression. In the 1960s, the Swedish child psychologist Stina Sandels published her pioneering work on children's behaviour in traffic (Sandels, 1968). She pointed out why traffic safety for children needs to be the responsibility of adults, and in a series of studies she communicated that a child's

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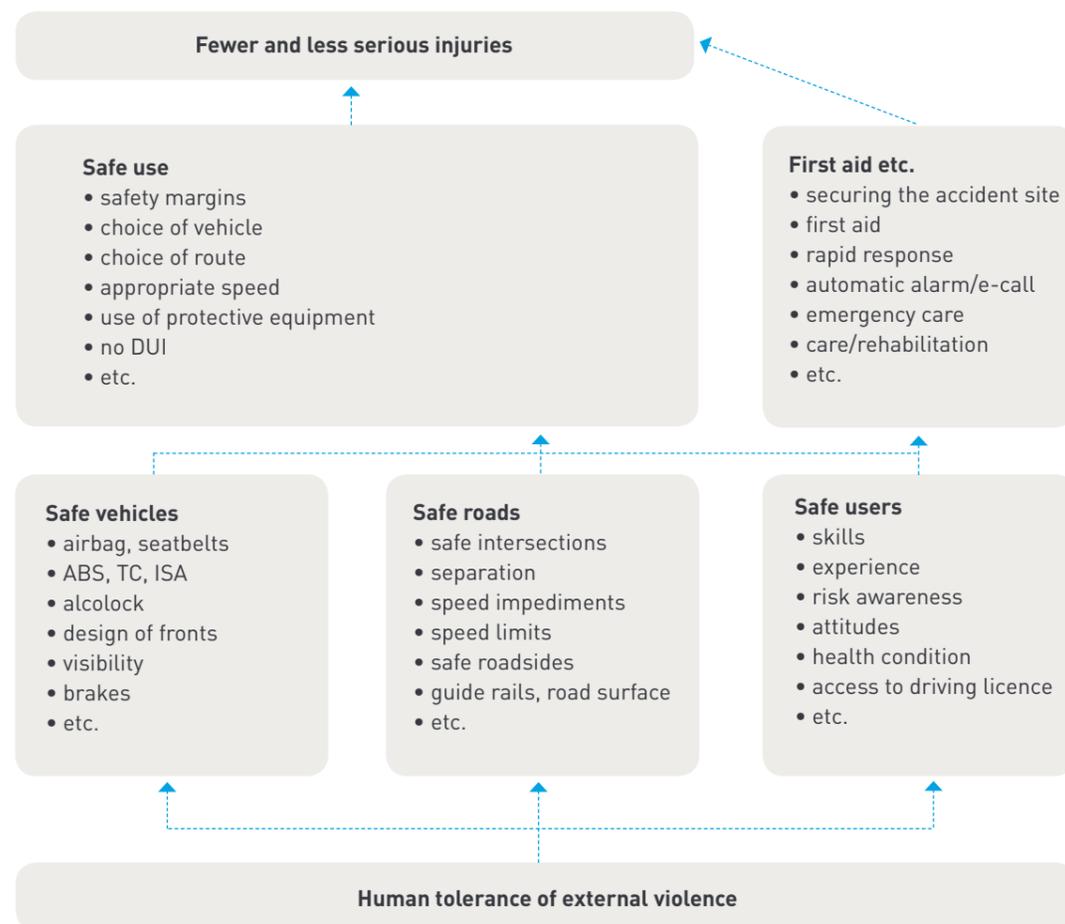


Figure 1.1: A system perspective on safe use of the road traffic system.

qualifications for interpreting and understanding traffic situations differ from those of adults. Children cannot learn safe behaviour in the same way as adults and therefore need safe areas for outdoor play and mobility on foot or bicycle. When the NCRS established Children's Traffic Club in 1966, emphasis was placed on communicating this knowledge to parents.

The International Year of the Child 1979 made children and traffic safety a core area, and the 'Safely to School' campaign was established. Its goal was to reduce the number of accidents involving children in local communities where a large number of accidents occurred. Traffic education was made a mandatory subject at the primary level. In the 1980s two white papers were published, the first confirmed that measures to improve traffic safety for children should be prioritised (Report No. 14 to the Storting, On Traffic Safety etc.) and the second made traffic

a mandatory subject in teacher training (Report No. 18 to the Storting, On Traffic Safety and Traffic Education). The effort to safeguard children's road to school was considerably reinforced in preparation for school enrolment by six-year-olds in 1997, and the counties' traffic safety committees played a key role in this context. Report No. 18 to the Storting made traffic a mandatory part of the ten-credit study of nature, society and environment in the Framework Plan for General Teacher Training in 1998.

When Vision Zero was adopted by the Storting in 2001, traffic education was described as an important and natural part of traffic safety promotion. In the report 'Traffic education – the road to understanding traffic', published in 2003, the Ministry of Transport provided a total overview of the status, assessments and recommendations for strengthening traffic education in day-care centre, schools and teacher training colleges. In the introduction

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of the Knowledge Reform in 2006, traffic education was included as a mandatory topic with competence goals for the 4th, 7th and 10th grade. At the upper secondary level, traffic is associated with some of the vocational subjects.

Traffic education in day-care centres

A new framework plan for the content and remit of day-care centres enter into force from the autumn of 2017. The consultation draft version says that day-care centres should 'help the children explore different landscapes, become familiar with institutions and places in their local community and learn to move around safely'. Previous versions of the framework plan have not included any similar formulations. This will establish better coherence between the framework plan and the provisions in the regulations for health care in day-care centres and schools. The owner of the day-care centre is responsible for ensuring that the staff possess updated knowledge about the prevailing regulations for safe transport of children, be it by car, bus or bicycle, or on foot. The owner of the day-care centre is also responsible for ensuring that an internal control system for prevention of injuries and accidents in the facility is established, and the director is responsible for monitoring compliance. Traffic safety promotion is a matter of physical facilitation, but also of attitudes and behaviour in children and staff members.

Traffic education in primary and lower secondary schools

The Knowledge Reform encompasses subject curricula that describe the skills that students should have achieved at the various grade levels. The curricula have the status of regulations and form the basis for planning and implementation of the teaching by schools. The school owner is responsible for ensuring that the students are provided with training in accordance with the national curriculum and internal control system. Traffic safety training is encompassed by competence goals in the subjects of PE at the primary level and natural sciences at the lower secondary level. In addition, the school owner may choose to provide traffic education as an elective subject at the lower secondary level. The Ministry of Education and Research has submitted the white paper Report No. 28 (2015–2016) to the Storting: Subjects – Specialisation – Understanding. A renewal of the Knowledge Promotion Reform, about the subject content in primary and lower secondary school. The Government points out that the curricula are overloaded, that the competence goals should be

coordinated at the different levels, that the plans should facilitate progression and opportunities for in-depth learning, and that a renewal of the subjects and curricula is called for. Traffic and traffic safety education in primary and lower secondary schools should be seen in the context of the upcoming renewal of the subject content and refinement of the national curriculum.

Traffic education in upper secondary schools

At the upper secondary level, traffic safety as a subject is linked to the vocational training programmes in service and transport, transport and logistics and professional driving. The training should provide a basis for a career in transport of people and goods. The subject should bestow vocational skills that ensure effective, safe, environmentally friendly and profitable transport services. Furthermore, the subject should help develop professional drivers who can handle diverse and challenging traffic situations under changeable road and weather conditions. We refer to relevant competence goals in the Knowledge Reform, described on the NCRS website.

COORDINATION OF MEASURES AT THE GENERAL LEVEL

The main message in the white paper on traffic safety promotion, Report No. 40 to the Storting, concerns coordination at the general level and cross-sectoral challenges in traffic safety promotion. The paper points out that traffic safety promotion goes far beyond the road authorities' area of responsibility. Emphasis is placed on how various ministries and agencies ought to take a joint responsibility for prevention of traffic accidents, including the police, health and education sectors.

Under the topic of traffic education, the white paper points to the following key areas of collaboration:

- Between the school owners and relevant NGOs such as NCRS to ensure informed efforts for traffic education.
- Between, schools, parents, local councils, public agencies and NGOs to ensure bicycle training and facilitate safe cycling.
- Between the Norwegian Public Roads Authority, the driving schools, educational institutions and NGOs to ensure full use of the potential inherent in driver training.



## Chapter 2

# A COMPREHENSIVE MODEL OF BEHAVIOUR CHANGE

Today we have an extensive set of rules telling us how to behave in traffic. We also know quite well how road users actually behave in the traffic environment. Most of them behave correctly, but some road users engage in insufficiently safe behaviour. This is partly due to unintended errors, but also to deliberate choices of incorrect behaviour. The reasons for wrong behaviour may be of a physiological, psychological, social or cultural nature (Gregersen, 2016).

Various factors determine people's motivations, notions, attitudes and behaviour. Comprehensive research has developed a number of theoretical models that help us understand how we function. With the aid of these, we can obtain a concrete impression of the factors that influence each other and the factors that we need to consider when we seek to modify human behaviour.

In the following we will describe a selection of the most widely accepted and applied theoretical models for human behaviour, primarily seen in a psychological/social perspective.

### THEORETICAL MODELS OF BEHAVIOUR – HISTORICAL DEVELOPMENT

Traffic safety promotion is largely about modifying people's behaviour, so that they behave in a safe manner. There are many ways to achieve this, for example by way of targeted educational programmes, a well-designed traffic environment and surveillance coupled with penalties. Irrespective of the approach, it is an advantage to make use of existing knowledge about behaviour change and traffic psychology. A theory provides insight into how different factors are related and interact. With the aid of a theoretical model we can understand

what factors need to be targeted when we want behaviour to change. The social psychologist Kurt Lewin (1952) summed this up by saying 'There is nothing more practical than a good theory'.

One of the first definitions of attitude was formulated by Allport in 1935. His definition said that attitude is 'a learned predisposition to react positively or negatively to an object or a group of objects' (Allport, 1935).

Later, in 1977, Summers proposed a definition based on the familiar trilogy of thoughts, feelings and actions. She described these in more modern terminology as cognitive, emotional and action-oriented. The cognitive aspect concerns notions about an object, but also notions of how this object should be handled. The emotional aspect concerns the individual feelings that the individual experiences in relation to an object, while preparedness for action means to be ready to act with regard to the object. With this definition, Summers claimed that attitudes and behaviour are closely linked. Later studies, however, showed that the relationship between attitudes and behaviour is in fact quite tenuous (Summers, 1977).

### THE THEORY OF PLANNED BEHAVIOUR (TPB)

An explanation of the weak association between attitudes and behaviour was provided by Fishbein and Ajzen (1975), who pointed out that behaviour is influenced by a large number of factors. Moreover, previous studies had rarely taken special care to measure attitudes and behaviour linked to one and the same phenomenon. The correlation between attitudes and behaviour needs to be measured with regard to exactly the same action. They thus

■ A comprehensive model of behaviour change

developed a theory that included a greater number of factors. Initially, they referred to it as the 'Theory of Reasoned Action' (ibid.), but after a revision the name was changed to the 'Theory of Planned Behaviour' (TPB). TPB is a typical and widely used theoretical model that includes attitudes as well as behaviour (Ajzen, 1991).

TPB was developed to explain why people behave as they do, for example to explain why some people drive too fast or fail to wear a helmet. The theory shows that behaviour is influenced by the intentions we have to behave in a certain way, but also that the transformation of this intention into actual behaviour depends on the degree of control that we feel we have over this behaviour. The intention to behave in a specific way is determined both by the attitude to this behaviour and the subjective norms that apply to this type of behaviour.

A subjective norm is an individual perception of how others will react to a specific behaviour. These others may include friends, parents, colleagues or other people who are close to us. Note that this does not refer to the actual reactions from those in our environment, but our individual perceptions and expectations of them. This subjective norm can be true or false. In this context, control is a matter of perceived peer-group pressure. Behind this attitude lies a series of beliefs about behaviour and its consequences. With regard to speeding in traffic, this could include consequences in terms of accident risk, environmental impact, concern for others, risk

of detection, the joy of driving and so on. There is an element of cost-benefit analysis in the actors' beliefs.

Perceived control of behaviour refers to the beliefs that each individual holds about the possibilities of engaging in this behaviour. This may involve their own skills, but also external factors such as the weather and road conditions, the car's performance, speed limits etc.

Using the TPB model we can see, for example, that it will be useless to try to modify people's intentions to engage in a specific behaviour by attacking only the subjective norm if this does not tally with the actual norm among friends. We can also attack attitudes by modifying people's fundamental beliefs about a specific type of behaviour and its consequences.

**HEALTH-BELIEF-MODEL (HBM)**

Like the TPB, the Health-Belief Model (HBM) is frequently applied in health research to understand human health behaviour (Rosenstock, 1974). However, both are suitable for understanding behaviour in traffic. The end product of this theory is the degree of likelihood that someone will perform a certain act.

The size of this likelihood depends on three factors in the HBM model. The first is the result of a

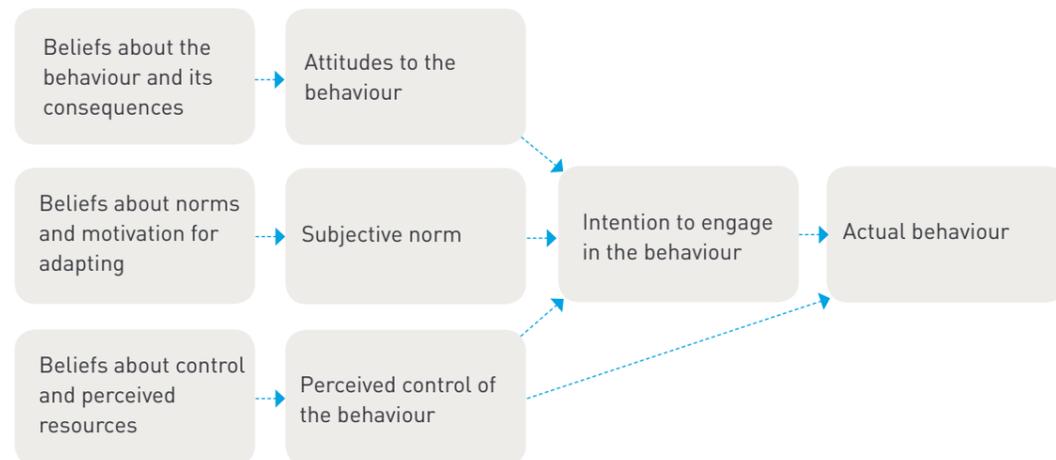


Figure 2.1: Theory of planned behaviour. Source: Ajzen, 1991

■ A comprehensive model of behaviour change

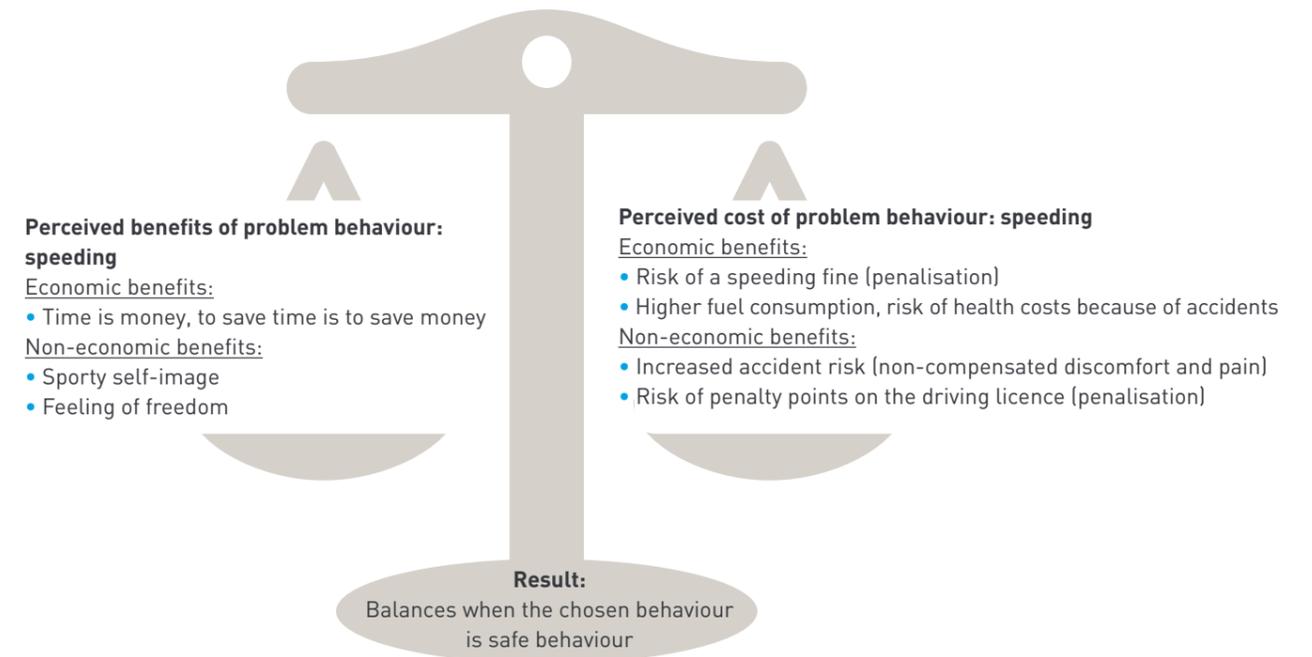


Figure 2.2: Factors that affect the cost-benefit analysis of changing a problematic behaviour. Source: Rosenstock, 1974

cost-benefit analysis, the second is the perceived threat, and the third is confidence in one's own abilities. Figure 2.2 shows examples of factors that influence the cost-benefit analysis of changing a problematic behaviour.

**The cost-benefit analysis** encompasses different aspects for different people. The benefits of slowing down include the perceived benefit of avoiding accidents, injuries and fines, while the costs may have the form of lost time, reduced enjoyment of driving and loss of social status.

**The perceived threat** is partly about the likelihood of falling victim to an accident or injury and partly about the seriousness of the outcome, i.e. the consequences. The estimated likelihood of becoming a victim could include an objective calculation of anybody's likelihood of falling victim to an accident. However, it could also involve an assessment of one's own likelihood, in light of personal skills, type of car or previous number of accidents: 'I have driven above the speed limit for forty years and have never been in an accident.'

Estimated consequences may include purely physical injuries as well as economic and social

consequences. The further assessment of the threat and the consequences depends on a number of background factors such as gender, age, ethnicity, education, personality, social class, group affiliation, habits, and knowledge about the behaviour and its consequences. If the risk is deemed high and the consequences are seen as serious, the likelihood of behaviour change increases.

**The third component, confidence in one's ability to engage in a specific behaviour**, concerns how the individual regards his or her own skills, physical capability and other abilities that need to be activated in order to engage in the behaviour in question. It could also involve assessment of the ability to withstand peer-group pressure and perhaps violate certain cultural or social norms, for example at the workplace, in the family or among friends. A key feature of the HBM theory is that it highlights the need for a trigger that can affect the likelihood of taking a specific action. A trigger may cause the individual to go ahead and realise his or her intentions. He or she may be swayed by an information campaign with a targeted message, may have personally experienced his own or a relative's accident caused by this behaviour, or may have experienced the unpleasantness of being fined. With

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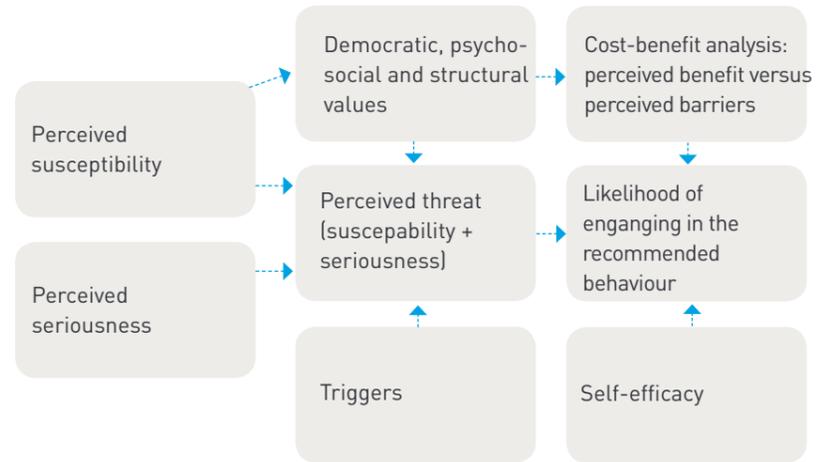


Figure 2.3: Factors in a Health-Belief model. Source: Rosenstock, 1974

the aid of an HBM model we can seek to increase the likelihood of a specific behaviour by pointing out the actual costs and benefits or by using various kinds of triggers. Figure 2.3 shows key factors in a Health-Belief model.

consequences of behaviour may predict intentions as well as behaviour. The theory thus also includes aspects from the HBM, for example.

A key difference between the TIB and the other models is that it explicitly includes habits as an explanation of behaviour, not just as an indirect indicator of intentions, but as a factor that directly influences behaviour. In the TIB, the term 'habit' refers to behaviour which is performed to some extent automatically without any conscious decision. When a high degree of awareness is involved in the decisions, these are instead referred to as intentions. Intentions are consequences of three different factors: social, emotional and personal notions about the consequences of a certain

### THEORY OF INTERPERSONAL BEHAVIOUR (TIB)

The Theory of Interpersonal Behaviour (TIB) shares certain features with the TPB and has a similar ambition to predict people's behaviour via their intentions (Triandis, 1982). As in the TPB, social factors and norms play a key role in the TIB. The theory also emphasises how notions about the

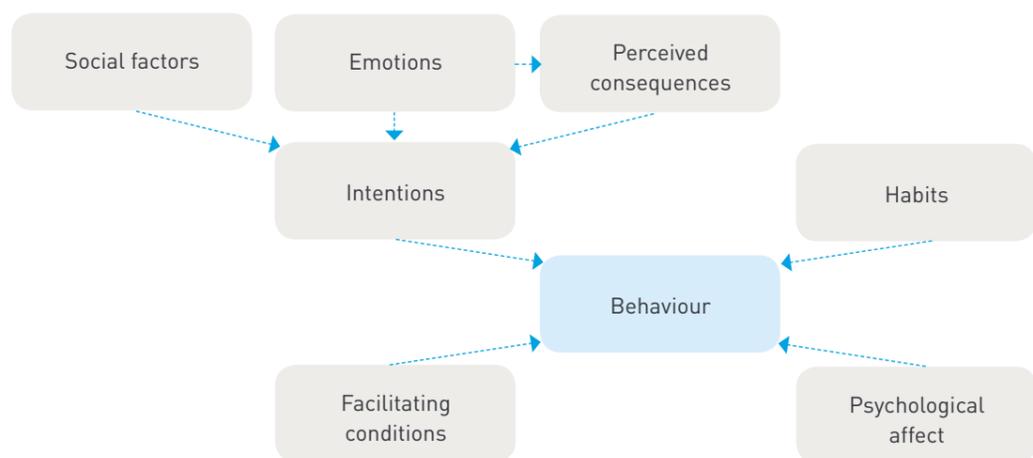


Figure 2.4: Theory of interpersonal behaviour. Source: Triandis, 1982.

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behaviour. Social factors may include ideas of what is morally or ethically correct, as well as notions of the expectations prevailing in an individual's immediate social network with regard to both the behaviour in question and the person involved. The latter concerns the extent to which a behaviour fits a person's 'image'. Emotional factors concern feelings associated with specific behaviours. Notions about consequences refer to what the person in question believes might happen if he or she performs specific actions and what these consequences entail. In other words, this also involves elements of cost-benefit analysis.

The end product of the model is behaviour. The TIB expresses this exactly like the HBM: the likelihood of a specific behaviour, for example using a bicycle helmet or staying below the speed limit. In addition to habits and intentions, two situational aspects are also pointed out: 'facilitating conditions' and 'psychological arousal'. These may bolster or counteract the likelihood of engaging in a certain behaviour at a given time. See Figure 2.4.

### ELABORATION – LIKELIHOOD MODEL (ELM)

The Elaboration Likelihood Model (ELM) focuses on understanding the cognitive processes that underlie attitude changes. It is a so-called dual-process model, meaning that it is based on two different processes through which messages affect attitudes (Petty and Cacioppo, 1986). The model describes how people choose different routes to assess a

message. The ELM defines two such processes, or routes, for how we handle messages:

- The central route is used when a lot of energy is devoted to systematically considering the relevant aspects of the matter, person or message in question. The arguments in the message are carefully assessed, a lot of thought is given to the implications of the ideas presented, and they are assessed in light of personal knowledge and values.
- The peripheral route is used when the message is superficially considered and is assessed in accordance with simple rules of thumb or in light of characteristics that are not directly linked to the argument (the messenger's appearance, style and skills, or the opinion of the majority).

The ELM is about the conditions that cause people to think either systematically or in simplified terms. All people make use of these two ways of thinking, but the question arises as to when one is used more than the other. To take the central route, at least two factors are required: motivation to consider the message and the intelligence needed to understand and analyse it. If one of these conditions is missing, the peripheral route is chosen. Both routes can lead to changed behaviour. According to the theory, processing through the central route causes more permanent change and better resistance to counterarguments. Processing through the peripheral route is more likely to produce only transient change.

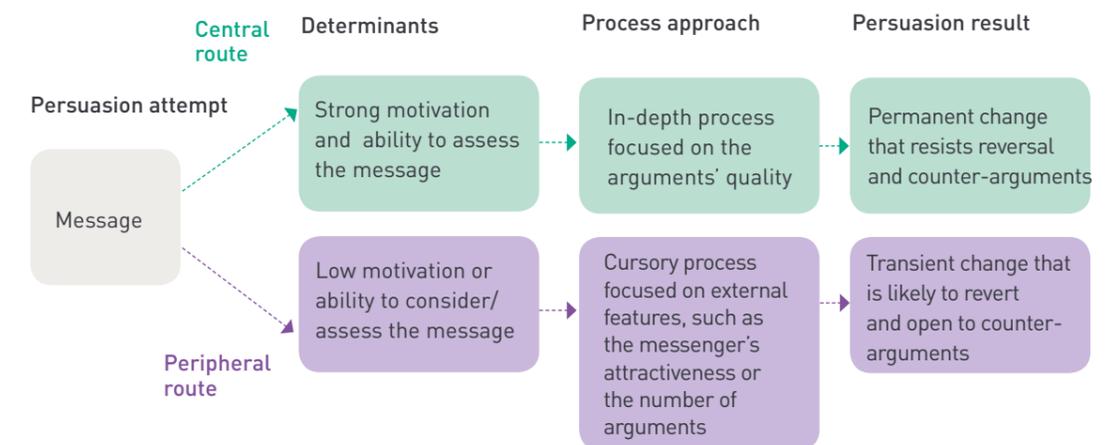


Figure 2.5: The Elaboration-Likelihood Model Source: Petty og Cacioppo, 1986

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## TRANSTHEORETICAL MODEL OF CHANGE (TTM)

The Transtheoretical Model of Change (TTM) seeks to explain the various stages of the process people go through when they change their behaviour (Prochaska and DiClemente, 1983). The objective is thus not to explain what factors affect attitudes or behaviour, but to focus on the mental change itself and how it occurs. According to the TTM, an individual goes through six different stages before the new behaviour has become established. The stages are:

1. The person has no thoughts of change or the need for change (precontemplation).
2. The person contemplates changing, feels a need to change and considers taking action (contemplation).
3. The person is prepared to take action, and considers actively addressing a certain situation (preparation).
4. The person takes action and changes his or her modes of thought and behaviour in a specific direction (action).
5. The person confirms the change and wants to maintain the new mode of behaviour and the new situation he or she has created (maintenance).
6. The person completes the change process (termination).

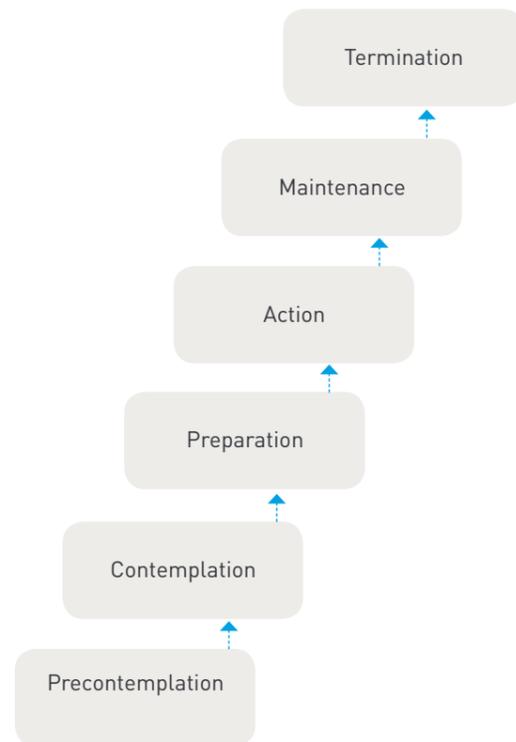


Figure 2.6: The Trans-Theoretical Model of Change (TTM). Source: Prochaska and DiClemente, 1983.

In the first stage, there is no awareness that one's personal behaviour represents a problem, and hence no ideas about changing it. In the second stage, when change is being contemplated, there is an increased awareness of the benefits of a change of behaviour. The problem, however, is that the disadvantages still predominate. In the third stage, when the person is prepared to take action and has decided to undertake the change, he or she is seeking information on how to proceed. Individuals who have reached the fourth stage, action, will go through with adopting the new behaviour. In the fifth stage, the new behaviour has been sustained for an extended period and is being maintained. The entire process ends when the new behaviour is regarded as established and the change process is terminated. Figure 2.6 shows the various stages in the change process.

## A COMPREHENSIVE MODEL OF BEHAVIOUR MODIFICATION

The theories we have presented above share a number of features, but they also differ in some respects. Each

theory adds aspects that enhance our understanding of the determinants of human behaviour and thus also points out approaches to and preconditions for effective efforts to modify this behaviour. Three of the five theories point out relationships between various factors and behaviour, including factors such as intentions, attitudes and social aspects. All three focus on the results of the efforts made, although certain elements of the process can be regarded as a result. Emphasis is placed on intentions, especially by the TPB, as a transitory stage before the change in actual behaviour. In the HBM, the outcome is defined as the likelihood that the new behaviour will be established. With this theoretical basis as our point of departure, we have developed a comprehensive model of behaviour change or behaviour modification, in which we have sought to combine key aspects of all five theories. This model has been developed by the Advisory Group to the Norwegian Council for Road Safety, and we refer to it as the Model of Behaviour Modification (Norwegian acronym: MAP).

The first stage of the model involves selecting a problem area and analysing how the problems manifest

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themselves. At this stage, a decision is made as to the objective: to change attitudes, intentions and/or actual behaviour. The target group for the efforts must then be defined on the basis of their background factors.

All the theories presented above highlight background factors, but only the HBM includes them specifically in the model. The TPB and TIB both include them, but mostly as self-evident preconditions that do not merit any explicit mention. Examples of such background factors that we deem important for the effort to promote traffic safety include:

- road-user role, i.e. cyclist, pedestrian, motorist etc.
- age and gender
- education, which may include regular schooling, but also experience and knowledge about traffic or a specific traffic-related area
- social relationships, which may include group affiliation, e.g. family/household type, school, workplace, peer group and leisure group
- socioeconomic aspects, which may include individual or family income, housing, employment, etc.
- geographical place of residence, region, municipality, school district or type of residential area.

We thus have an initial starting point and can continue building our model.

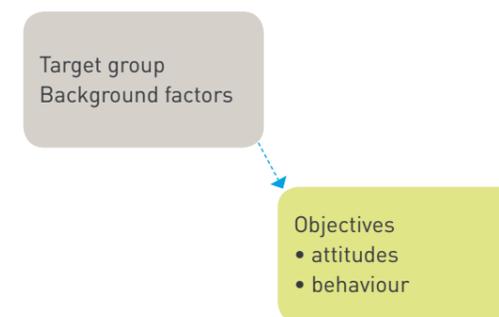


Figure 2.7.1: What do you wish to achieve for whom?

The background factors form the basis for defining the target group when a measure is planned. In addition, they help reveal what kind of knowledge, insights and ideas we have about a number of phenomena. These concepts partly overlap, but can nevertheless be used to point out three nuances of mental processes that influence behaviour. In our comprehensive model, we have defined these concepts as follows:

- Knowledge is the facts that a person has absorbed about the outside world and causal relationships.
- Insight refers to the understanding of how various phenomena and behaviour affect each other.
- Notions highlight that people's world views are subjective and may be true or false, but they are still deemed true by the individual and thus govern behaviour.

Knowledge, insight and notions are largely determined by the background factors outlined above. Examples of situations in which knowledge, insight and notions are deemed important for improving traffic safety include:

- Consequences of existing and new behaviour, such as a reduced risk of accidents or avoidance of fines. According to the HBM, such a review of consequences also includes a cost-benefit analysis.
- Personal risk, meaning the likelihood of being affected by hazardous consequences of existing and new behaviour.
- Social norms, peer-group pressure and expectations from immediate social networks.
- Social norms and rules of conduct.
- Majority opinions.
- Personal abilities and qualifications to engage in a particular behaviour.

To proceed, we need to identify the knowledge, insights and notions in the target group that hold the key to change. What would we need to develop or modify in the target group in order to achieve the expected outcomes? We therefore add a box between the target group and the outcome in the model. See Figure 2.7.2.

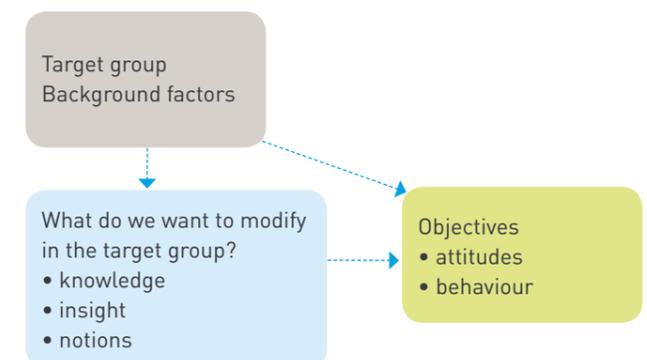


Figure 2.7.2: What do we want to modify in the target group?

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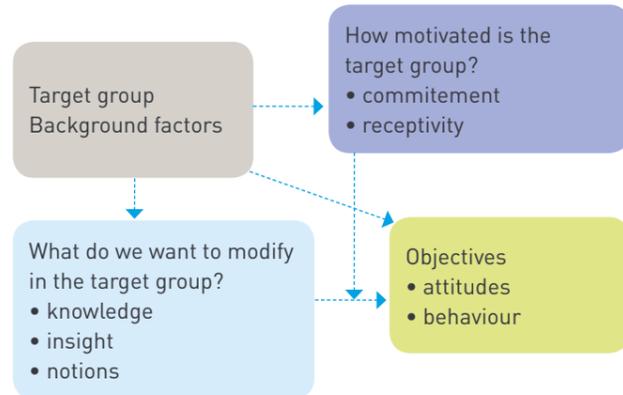


Figure 2.7.3: How motivated is the target group?

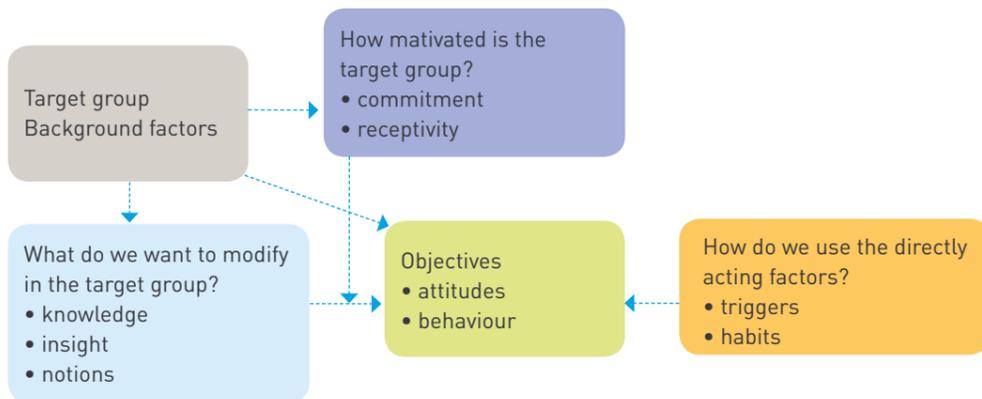


Figure 2.7.4: How do we use the directly acting factors?

A number of factors need to be analysed. There are certain preconditions for changing a person's knowledge, insight and notions. The willingness to change behaviour is decided by the person's motivation and commitment. If he or she is strongly motivated and committed, there are good prospects for achieving changes of attitudes, intentions and behaviour. In a process of change, we thus need to have some knowledge about the target group's motivation and commitment. The total knowledge about the target group's background, motivation and commitment will decide the educational strategy and methods, and the channels of influence that will be used. We have therefore added knowledge

about the strength of the target group's motivation and commitment to the model. See Figure 2.7.3.

In addition, a number of external factors have a direct effect on behaviour without going by way of knowledge, insight or notions. In the model we refer to these as 'directly acting factors'. These could be external influences such as the weather and road conditions, triggers of various kinds or established habits. When seeking to modify behaviour, it is crucial to determine whether these factors can be used as reinforcements or whether they constitute barriers to be overcome. See Figure 2.7.4.

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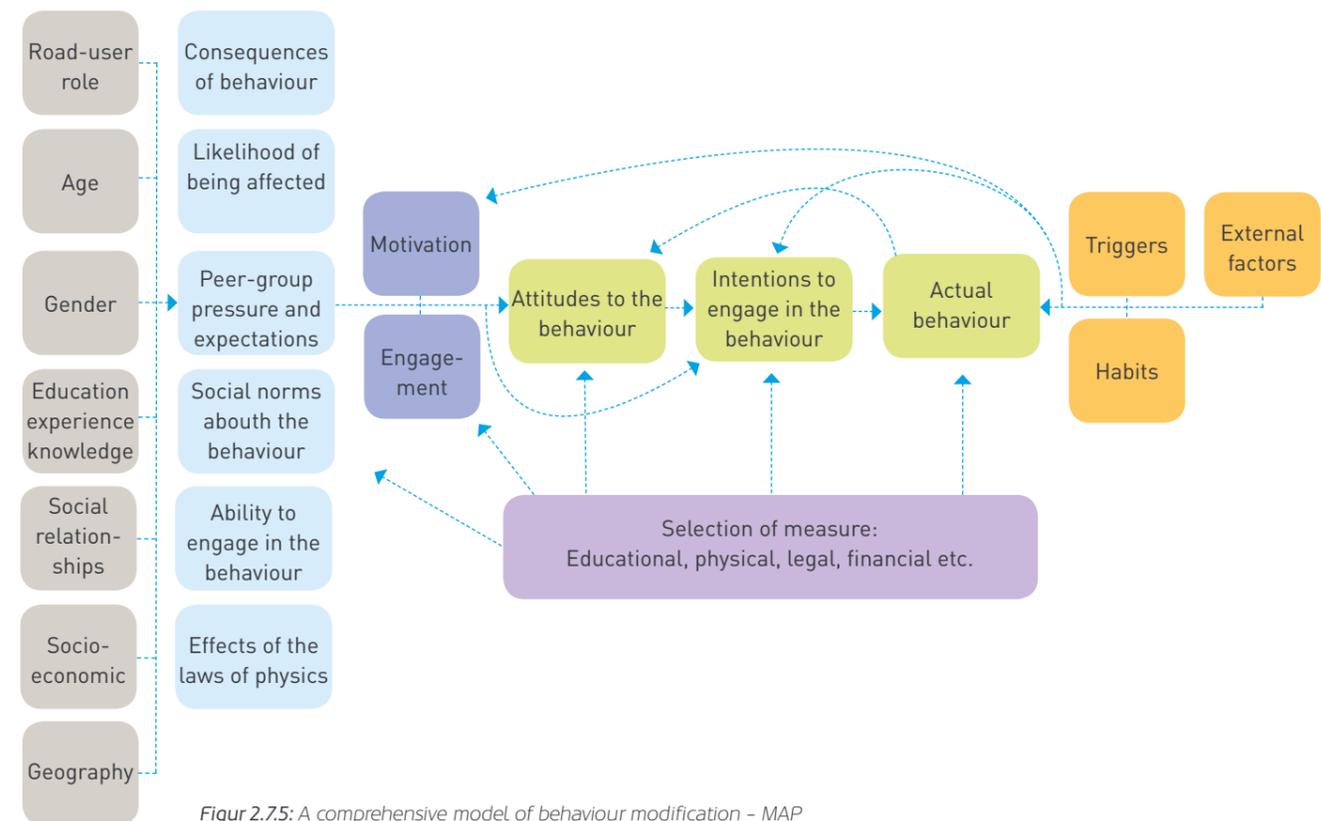


Figure 2.7.5: A comprehensive model of behaviour modification - MAP

The model in its simplified form is thus complete. In Figure 2.7.5, the content of the boxes has been specified in more detail. We have also added a box that underscores the importance of selecting and adapting measures to achieve the desired

effect. The figure illustrates how various types of measures can be combined to achieve maximum impact. In the next chapter we will discuss various measures in more detail, with a focus on educational methods.

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### AN EXAMPLE OF HOW TO USE THE MODEL – A PLAN FOR SAFE BICYCLE USE

Here we will show an example of how the model can be applied to measures that aim to teach children how to use their bikes safely, cf. the competence goals for seventh grade: 'The pupils shall be able to practise safe use of their bicycle'. We start from the boxes or categories with different colours and see whether they have any relevance for our intervention. Keep in mind that we do not have to use all of the boxes; select the factors that are relevant to the project in question.

We will start with the green and grey boxes and define the issue and target group.

Let us assume that we have seen pupils who have been persuaded by their peers to cycle in places where this is not permitted or where this is especially risky, that they carry more people on the bicycle than permitted, and that some minor accidents have occurred. We wish to address this situation. For our example, we choose to define the following categories:

- Road-user role: cyclist
- Age and gender: 11-12-year-olds/fifth-graders, both boys and girls.
- Socio-economic and geographic factors: Oslo's East side with a well-developed network of bicycle and pedestrian paths. Not all pupils have bicycles, and the teacher or training course provider needs to take this into account in the planning and implementation.

Let us look at the blue boxes. First, the pale blue boxes that contain knowledge, insight and notions.

What kind of previous knowledge do the pupils have about cycling? What do they know about challenges and common causes of accidents? This can be established through interviews or simple tests. What is the impact of peer-group pressure and social relationships: is there anyone in the target group who merits special attention?

When addressing safe use of bicycles, we should not choose an excessively broad scope. There should not be too many messages. We must thus make some choices in the pale-blue categories. In light of the

analysis we made in the introduction to this section, we choose to focus on the following boxes:

- Social norms, peer-group pressure and expectations from immediate social networks when it comes to riding a bicycle safely.
- Social norms and rules of behaviour (the majority's opinions).
- The pupil's abilities and preconditions for engaging in behaviour change.

These choices will set the direction of the further efforts involving the other categories.

Next, we look at the dark blue boxes that contain the pupils' motivation and commitment.

We know that some pupils ride their bicycle all the time, while others do it more rarely. The degree of motivation and commitment will vary considerably, so we need to start with a shared experience and a practical assignment to include everybody.

We take a look at the yellow boxes concerning assessment of the factors that have an immediate effect. We deem bad habits to be a factor that needs consideration. Changing bad habits is often more difficult than learning new ones. It is thus important to establish some reward systems and pay attention to the most rambunctious boys in particular.

Now, it is time to specify the objectives and establish an evaluation plan.

We thus proceed to the purple box and decide the choice of intervention. In this example, our main focus will be on educational measures. We could, however, have expanded the project by combining a number of measures, such as letting the pupils contact the local authorities to improve the maintenance and lighting of bicycle paths, or establish more safe road crossings.

In the next chapter we will provide further details of educational methods that will be key instruments in planning, implementation and evaluation of teaching and other interventions. We will return to the example involving the safe use of bicycles in Chapters 3 and 4.

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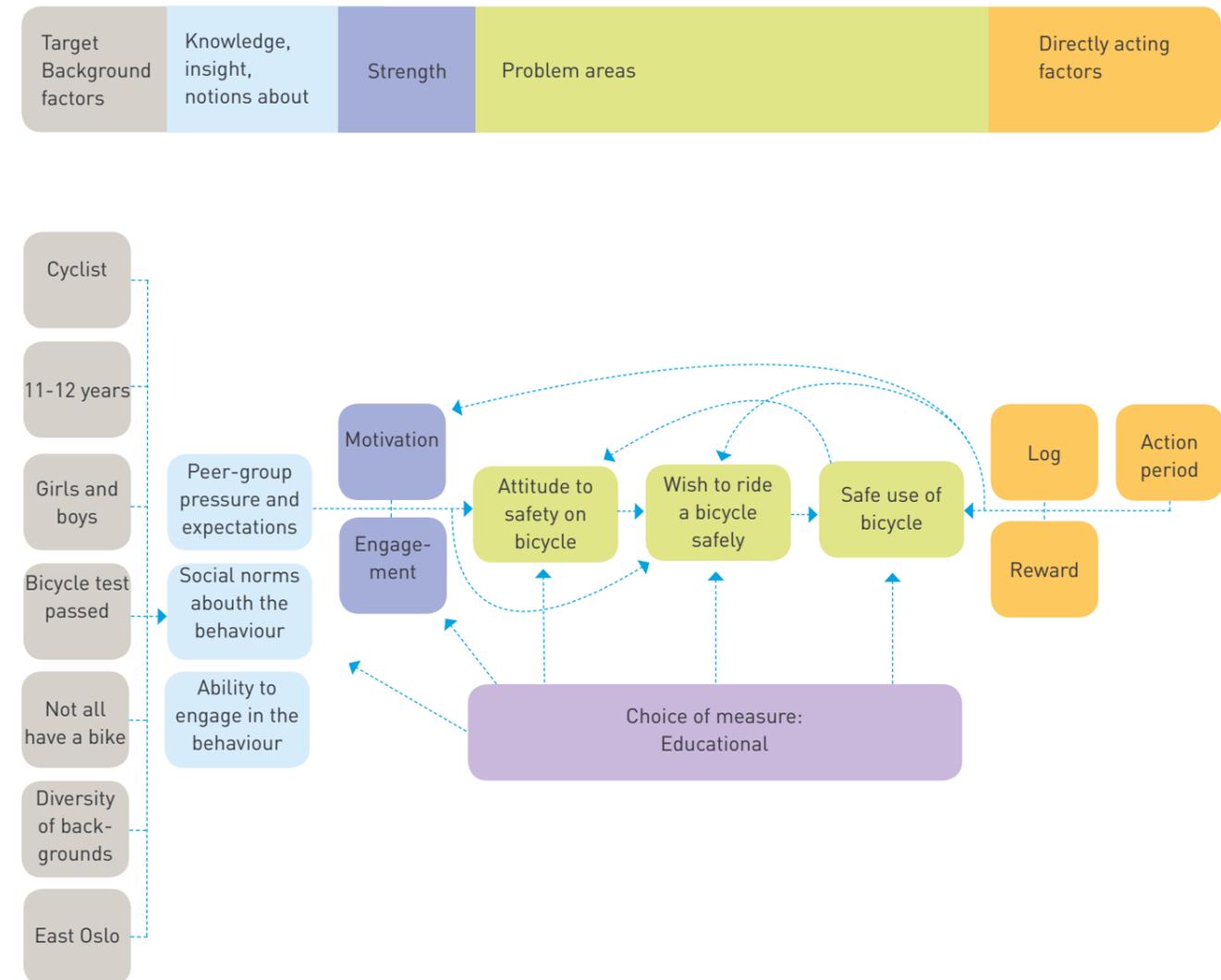


Figure 2.7.6: Example of a completed model of behaviour modification, the planning stage – safe use of bicycles.



## Chapter 3

# PEDAGOGICAL MODELS IN TRAFFIC EDUCATION

School pupils are one of the NCRS's important target groups. This includes pupils at the primary, lower secondary and upper secondary levels. Another important target group is day-care centre pupils. In this respect, the NCRS must observe the school's terms of reference, curriculum and competence goals in selected subjects and to the Framework Plan for the Content and Tasks of Kindergartens. The core curriculum (L93) emphasizes the schools' mission for its pupils and for society.

In the Report no. 28 to the Storting (2015-2016) titled 'Subject – Specialisation – Understanding. A Renewal of the Knowledge Promotion Reform', the Ministry of Education and Research stresses that 'the school must both educate and cultivate'. In the preamble, it is emphasized that 'development of knowledge, skills and attitudes is important for coping in one's own life, participating in the labour force, becoming part of close social contexts and participating in social life'.

In other contexts, the report also underscores that provisions must be made to provide the pupil with good conditions for developing values. Furthermore, interdisciplinarity is highlighted: 'Interdisciplinarity, where pupils work with issues or topics across academic subjects, may contribute towards better cohesion within the curriculum. The Ministry wants to elucidate the following three topics: democracy and fellow-citizenship, sustainable development and public health and life mastery. The topics are to be described in the core curriculum and be included in the curricula of the subjects where they are relevant.'

Traffic education can be linked with several of these interdisciplinary topics and become instrumental in relevant and good education. In Chapter One – Looking at traffic safety promotion – we discussed

features of social development that affect both the schools and traffic safety work.

Report no. 28 to the Storting stresses that learning strategies and reflection about one's own learning must be elucidated in subject curricula to the extent this is relevant for competence in the subject because it is important for the pupil's learning. In the present context, we might say that the school is to contribute important knowledge about traffic and thereby help cultivate the pupils' traffic awareness. The pupils must learn about traffic safety, of course, but it is equally important for pupils to develop attitudes and gain insights that enable them to assess and develop arguments in favour of safe behaviour in traffic.

Whether it be in the area of campaigns or education, there are large challenges associated with quality assurance of both design and implementation of measures. In the preceding chapter, we discussed a model for behaviour modification that provides an account of some of the factors at play in traffic safety work. In this chapter, we aim to look at pedagogical models that can help us ensure quality in the development, implementation and evaluation of projects, courses and materials in traffic education. These models relate to the purple-coloured boxes in Figure 2.7.5 and are designed to influence and change the content in the blue (dark and light-shaded) and the green boxes. In this respect, although we indicate pupils and training in a school context, we emphasize that the methods presented here are also appropriate for use in other contexts, for example for measures aimed at young people in leisure time or adults as recipients of information – in brief, in all situations where we wish to motivate, convey information and influence people.

Once we have chosen a topic for a learning

measure, project or campaign, the next question is how we can best adapt learning for the target group. There are models having different perspectives, and they are not mutually exclusive. It is a matter of choosing the right tool for the right task. The models can help us remember important factors that should be taken into account in a teaching situation, briefing situation or in a phase of evaluation; they can help us make provisions for good learning and can aid in developing evaluation strategies. The terms used in the models for behaviour modification can be linked up with pedagogical organization. This includes knowledge, insight and notions as well as motivation and involvement. Pupils' notions, pre-knowledge and attitudes play a significant role in their learning processes.

**THE DIDACTIC RELATIONAL MODEL**

This didactic model was developed towards the end of the 1970s in conjunction with the Norwegian environmental education project (Bjørndal and Lieberg, 1978). The model emphasizes important aspects or didactic categories in a planning process for good teaching. It currently appears in various forms in the pedagogical literature (see, for example, Hiim and Hippe, 2009), but the following six didactic categories were originally used: outcomes, content, learning activities, learning conditions relative to the individual pupil, framework factors and assessment. The model provides a system of terms and a conceptual framework for teaching.

It illustrates that there must be a connection and reciprocity between the teaching objectives and the other didactic categories that are mentioned (see Figure 3.1).

Content posits the topic or the particular subject matter that the pupil is to acquire. In the school system, it is a matter of what the curriculum stipulates in relation to the interests of the pupils and society.

Learning activities tells how the pupils and class as a whole are to work to achieve the outcomes. Pupils come to the classroom with notions and aptitudes that the teacher should be aware of and take into account. Therefore, learning conditions represents an important category in the model.

Framework factors indicate the restrictions or opportunities in teaching and encompass everything from the physical design and size of the classroom to the personal competence of the teacher.

Outcomes are normally subdivided into knowledge outcomes, attitudinal outcomes and skills outcomes. Once the topic or project has been chosen, we then formulate, as specifically as possible, the knowledge, attitudes and skills outcomes. These establish the basis for the choice of content and learning activities, which are again dependent on the pupils' learning conditions and the framework factors provided by the school.

Evaluation of the pupils' learning outcomes and interim achievements must also be planned and related to the other didactic categories. In order to enable good assessment strategies, the objectives should be formulated as specifically as possible,

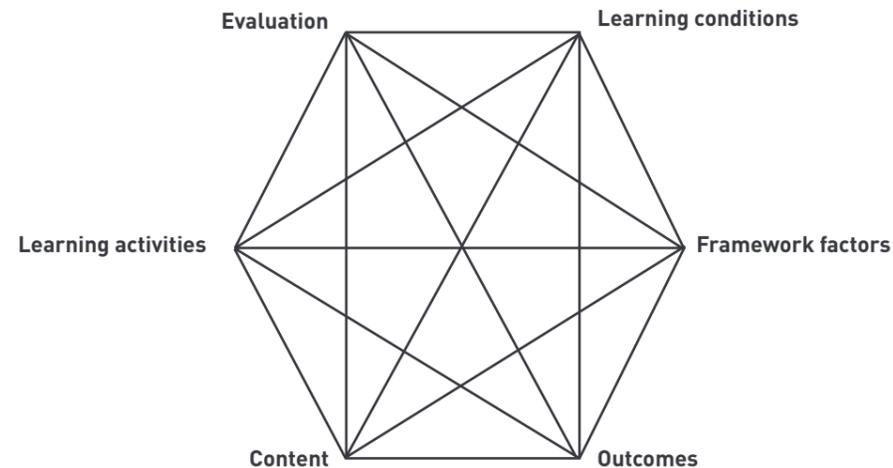


Figure 3.1: The didactic relational model according to Bjørndal and Lieberg (1978)

using active, measurable verbs, i.e. precise indications of what the pupil should know or be able to do after being taught. This is crucial for our choice of content, learning activities and assessment/evaluation. Framework factors and learning conditions will also affect the choice of objectives, content and learning activities. Thus, we see that all the didactic categories are mutually interdependent.

**FORMULATING OUTCOMES**

Modern subject curricula have outcomes specifying the competence that the pupils are to achieve – competence goals. Based on the competence goals, the teacher or school owner must formulate specific learning outcomes, i.e. outcomes that describe in detail the subject matter and methods. The outcomes should define the level at which learning is to take place. Must the pupils be able to assess and make arguments for or against construction of bicycle and pedestrian paths, or must they simply be able to recall a list of arguments in favour of constructing these paths? The outcomes must be measurable.

Here is an example of a formulated outcome that is difficult to assess:

- You must know what equipment is required on a bicycle.
- You must know how to use a bicycle helmet correctly.

And here is an example of how you might use active verbs instead:

- You are to choose the equipment that is required on a bicycle.
- You shall demonstrate correct use of the bicycle helmet and tell how the helmet protects the cyclist's head.

Since competence is often regarded as a combination of knowledge, attitudes and skills, it may be useful to scrutinize the kinds of active verbs that can be used to evoke knowledge, attitudes and skills at various levels of competence. Earlier theorists developed hierarchical systems, so-called taxonomies, for knowledge, skills and attitudinal objectives. We can use these taxonomies when we specify specific outcomes for a teaching plan or project.

**Knowledge objectives**

Bloom's taxonomy (Bloom et al., 1956) for the cognitive domain operates with six levels, but for our purposes, we choose to reduce the number of levels to three because we believe that this provides us with the tool that we need. See Figure 3.2.

**High cognitive level – evaluate and analyse:**

The pupil has grasped the knowledge and is able to analyse. The pupil can discuss, rank and draw conclusions with a reasoned assessment and a critical sense.

**Medium cognitive level – apply:**

The pupil has understood and can adapt knowledge. The pupil is able to explain in his/her own words and apply the knowledge in various situations.

**Low cognitive level – reproduce:**

The pupil has internalized and understood. The pupil relates, describes and lists what he/she has learnt.

We underscore that there is a gradual transition between the levels and that the subdivision also depends on the kind of knowledge that we have predefined. Objectives that call for reproduction or retelling may involve a considerable intellec-

Cognitive levels	Verbs that describe cognitive levels
Assess and analyse	generalize, draw conclusions, criticize, discuss, put forward arguments, defend
Apply	deduce, propose, construct, organize, give an account of, compare
Reproduce	recall, retell, describe, mention by name, enumerate/list, define, make reference to

Figure 3.2: Three levels of knowledge outcomes

tual burden, depending on content. Mere recall is not the only thing that is involved in reproducing material. For example, relating the main content in Einstein's general theory of relativity will be a particularly difficult task for most people, even though we use the verb 'relate' in the wording of the objective.

**Skills outcomes**

Like Bloom, Simpson also has six levels in her taxonomy of skills (Simpson, 1972). Simpson developed her taxonomy in relation to psychomotor skills, but the taxonomy can be applied to skills of a more general nature. In our context, we have chosen to simplify the taxonomy into three levels. See Figure 3.3

**High level of skill –**

**develop, produce and renew:**

The pupil masters complex, composite skills and solves tasks in ways requiring different methods to

achieve the objective. The pupil demonstrates the ability and perseverance to reach his/her goal even though the task is demanding.

**Medium level of skill – choose, master:**

The pupil chooses amongst different methods the one that he/she thinks is most appropriate for reaching the goal. The pupil is able to provide a relevant justification for the choice. The pupil demonstrates the will to try to solve the task in an alternative manner if he/she fails to solve it on the first try.

**Low level of skill –**

**participate, follow instructions:** In an actual work situation, the pupil uses a method suggested by someone else, or one that the pupil has already learnt to use. The pupil follows a certain method and has difficulty coming up with alternative methods.

Skills levels	Verbs that describe skills levels
Develop, produce, renew	create, process, combine, adjust, modify, vary, improvise
Choose and master	adjust, treat, adapt, execute, maintain, carry out, put together, rectify
Participate and follow instructions	recognize, understand, take note of, receive, imitate, copy, try

Figure 3.3: Three levels of skills outcomes

**Attitudinal outcomes**

Krathwohl (Krathwohl et al., 1964) has developed a taxonomy for attitudes that includes descriptions of interest, attention, responsibility, the capacity to listen and act together with others; this is also known as Krathwohl's attitude ladder. It has five rungs, but for our purposes, we have also simplified this to three levels or ladder rungs. See Figure 3.4.

**High attitudinal level – integrate various values:**

The pupil demonstrates the will and ability to empathize with others, to act in relation to the best interest of the group and takes the initiative to act.

**Medium attitudinal level – appreciate:**

The pupil follows established rules and takes the

responsibility for tasks assigned to him/her. The pupil acts based on a given and acknowledged set of values.

**Low attitudinal level – receive and respond:**

The pupil demonstrates tolerance of other's beliefs and displays an ability to listen. He/she does not promote himself/herself at the expense of others.

As previously mentioned, these taxonomies can help us place teaching on an appropriate level for the pupils' learning. Using these kinds of taxonomies blindly, however, may have unfortunate consequences if we fail to assess the type of knowledge we are imparting and the context in which teaching takes place.

Attitudinal levels	Verbs that describe attitudinal levels
To integrate various values	judge, weigh, realize, generalize, make one's own, evaluate, oppose, reject, identify with
To value	accept, prefer, be happy about, see through, live by/comply with, take initiative to, show respect for
To receive and respond	apprehend, be aware of, be interested in, be attentive, take note of, be conscious of

Figure 3.4: Three levels of attitudinal outcomes

**CONFLUENT EDUCATION**

Confluent education (Grendstad, 1986) is a teaching method or a teaching strategy that stresses holistic thinking about the pupil and learning. In particular it places emphasis on experiential learning and is based on process-oriented methods. It stresses that teaching and learning must take into account and be based upon intellectual, emotional and psycho-motor aspects of the learner. This method seeks to consider the thoughts, knowledge, feelings and actions of the pupil in a holistic perspective. Traffic safety education uses this teaching method to a great extent.

The objectives of confluent education are:

- to make pupils aware of their own values, the consequences of these values, and to lead them to take responsibility for acting in accordance with these same values.
- to help bring out the learner's own resources in the best interests of the pupil, fellow human beings and the society in which they live

The core aspects of confluent education are:

- experience-based learning and the principle that 'learning is discovery'
- free self-determination, choice and responsibility for one's own learning
- learning as a subjective process
- integration of thoughts, emotions and psycho-motoric aspects
- teaching is combined with care for the pupil
- the pupil's learning to know himself/herself

**EXPLORATORY TEACHING AND LEARNING – THE 5E MODEL**

What are the characteristics of a good teaching situation – or, to stay at the level of the pupil: What are the characteristics of a good learning situation? Much research has been done on what yields good learning and on what the pupil has gained when the lesson is over. It is difficult to draw categorical conclusions, because there are so many variables in a learning situation. Moreover, pupils differ greatly and have different learning conditions, cf. the didactic relational model. Much of the research, however, points out that pupil-active teaching, when followed up with reflection, application, recapitulation and continuous assessment, yields good results (Hattie, 2013). Pupils must be motivated and involved, and teaching must be based on the pupil's pre-knowledge. Furthermore, the pupils should have the opportunity to explore, explain and extend their knowledge and understanding. Continual assessment (formative assessment) is recommended as an integrated part of teaching, and expectations should be placed on the pupils ('learning pressure'). In addition, it appears that variation in both teaching methods and learning arenas is important for pupil motivation and hence learning. In the following, we will discuss a model that has taken into account some of the knowledge pertaining to pupils' learning that research has fostered.

This is the so-called 5E model, which is a tool to support teachers in planning, implementation and evaluation of learning for the actively participating pupil. It is called the 5E model because all five pedagogical concepts start with the letter E: engage, explore, explain, elaborate, evaluate.

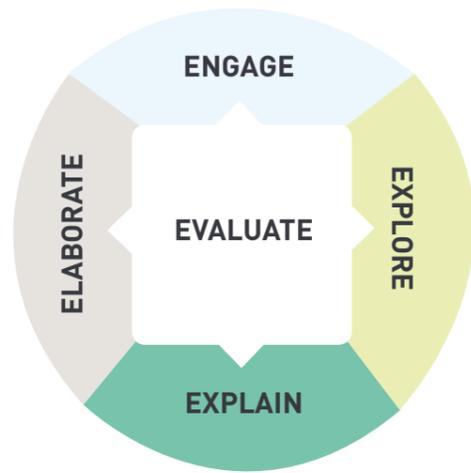


Figure 3.5: 5E-model.

The model can be supportive and help make exploratory teaching more explicit and targeted. It was developed in an American research environment that creates teaching programmes and conducts research on education and learning in the natural sciences. The Norwegian Centre for Science Education has further developed the model. Some of the text in this section has been borrowed from the website [www.naturfag.no](http://www.naturfag.no).

In education, the terms engage, explore, explain, elaborate and evaluate are interrelated. Evaluation is placed in the centre of the model because the purpose of evaluation is to promote learning, and because evaluation occurs in all phases of teaching. The term evaluation covers three types of assessment: continuous evaluation (formative as-

essment), final valuation (summative assessment) and self-assessment. Evaluation must be conducted continuously, be varied and a natural part of the instruction given. It can be given orally and in writing. The pupil is to evaluate his/her own learning, understanding and the quality of his/her own work. The teacher is to evaluate the pupils' learning in relation to the learning outcomes in a given topic or project. The evaluation is to be related to the objectives in the curriculum, and it must provide feedback that supports the pupils' learning.

By first determining clear learning outcomes (knowledge, skills and attitudes) and then applying the 5E model, the teacher can use the model as a tool for reflection to develop, plan, implement and evaluate teaching sequences.

Learning outcomes can be decided by both the teacher and the pupils. Teaching sequences that are planned can be either short or long. When the NCRS develops learning resources and courses, it is recommended that they be based on the 5E model and that the best possible provisions are made for teachers to follow this model.

**A toolbox for every main category in the 5E model**  
 When planning a teaching programme, it is important that the teacher think through what she is to do and what the pupils are to do; in other words, the roles that the two are to have in the classroom. You will find some keywords below describing the teacher's and pupils' roles in the various phases of a teaching programme in which the 5E model is applied. The list is meant as an aid in planning, a toolbox for the 5E model. When the NCRS arranges

Elaboration of the teacher's role	
Engage	<ul style="list-style-type: none"> <li>• Motivate, entice wondering and interest in a phenomenon/topic</li> <li>• Create a need for learning</li> <li>• Ascertain pre-knowledge and attitudes through active choice of values</li> <li>• Link learning material with what the pupils already know</li> <li>• Focus on the learning objective(s)</li> </ul>
Explore	<ul style="list-style-type: none"> <li>• Give the pupils a common 'academic platform'</li> <li>• Make provisions for and allow the pupils to investigate, take decisions, - search and collect information, interpret evidence, wonder about phenomena and pose questions</li> </ul>

Explore	<ul style="list-style-type: none"> <li>• Vary methods (reading, writing, speaking, listening, describing, explaining, presenting arguments, practical activities, collaborative group work and individual work)</li> <li>• Be a guide/tutor</li> <li>• Help pupils to 'build bridges' between pre-knowledge and new knowledge</li> </ul>
Explain	<ul style="list-style-type: none"> <li>• Allow the pupils to communicate their knowledge</li> <li>• Introduce new words, concepts and models</li> <li>• Devise models, give examples and explain</li> <li>• Challenge pupils' grasp of concepts</li> </ul>
Elaborate	<ul style="list-style-type: none"> <li>• Make demands on pupils to advance from the level where they are currently, find better or more elaborate explanations and use the most suitable models</li> <li>• Pose new questions that can be explored What do we know? How can we learn more? What might the explanation be?</li> <li>• Regard the subject holistically</li> <li>• Apply academic knowledge in new contexts</li> </ul>
Evaluate	<ul style="list-style-type: none"> <li>• Self-evaluation (pupil), formative assessment and summative evaluation</li> <li>• Reflect (with the pupils as well) about how and why various activities engage and motivate the pupils</li> <li>• Assess the pupils' pre-knowledge</li> <li>• Give feedback to the pupil and assess the pupil's learning process in relation to the learning outcomes</li> <li>• Compare the pupil's solution with other possible solutions (do this with the pupil)</li> <li>• Give feedback on how the pupil can prepare himself/herself academically</li> <li>• Give feedback on the pupils' academic argumentation</li> <li>• Give feedback on the pupils' explanations</li> <li>• Give feedback on the pupils' ability to apply course material and to generalize</li> <li>• Assess the pupils' learning outcomes</li> </ul>

Elaboration of the pupil's role	
Engage	<ul style="list-style-type: none"> <li>• Demonstrate pre-knowledge and express own ideas and concepts</li> <li>• Show curiosity, be involved and motivated</li> <li>• Discover a need for learning</li> <li>• Formulate questions and devise hypotheses</li> </ul>
Explore	<ul style="list-style-type: none"> <li>• Seize new experiences by exploring and finding solutions</li> <li>• Communicate and discuss observations and new experiences</li> <li>• Develop new knowledge</li> </ul>

Explain	<ul style="list-style-type: none"> <li>• Use academic terms, figures and symbols, models in explanations</li> <li>• Formulate and make arguments for one's own explanations</li> <li>• Reflect over the input of others</li> </ul>
Elaborate	<ul style="list-style-type: none"> <li>• Develop a deeper and broader understanding than what one had previously</li> <li>• Apply new knowledge and skills in new contexts and together with existing academic skills</li> </ul>
Evaluate	<ul style="list-style-type: none"> <li>• Reflection about the kinds of activities that engage and motivate pupils to learn</li> <li>• Assess own competence and what is needed to achieve learning outcomes</li> <li>• Evaluate own learning process in relation to learning outcomes</li> <li>• Choose learning strategies What works best for you?</li> <li>• Assess information</li> <li>• Assess academic arguments</li> <li>• Assess different explanations</li> <li>• Assess grasp of subject matter based on the ability to apply academic knowledge in new contexts</li> <li>• Assess whether the learning outcomes have been achieved</li> </ul>

courses, the course participants (teachers, kindergarten personnel, students etc.) are the 'pupils'.

### EXAMPLE OF THE USE OF THE 5E MODEL – SAFE BICYCLE USE

In Chapter 2, we used the model for behaviour change to plan bicycle safety education. We will now go one step further using the same example to take a closer look at pedagogical methods used in the 5E model. The activities have their basis in the five categories: engage, explore, explain, elaborate and evaluate. The objective of the safe bicycle use programme is that the pupils will change their behaviour, in light of the fact that we have detected detrimental behaviour.

#### Engage:

How can we engage the pupils?

- What kinds of bicycle accidents or near accidents have the pupils experienced on their way to school and during their free time? Give the pupils time to think and make notes. Following this, a list can be written on the blackboard. Are the pupils able to put some of these accidents or near accidents into categories?

- What types of accidents do they think are most common among pupils of their age? The pupils come up with their own hypotheses, and these are summed up on the board.

#### Explore:

What kinds of activities might contribute towards the pupils finding their own solutions to the issues?

- The pupils can design a questionnaire survey to map accidents or near accidents at their school, for example at their class level or for the school as a whole.
- Do these results conform with what they anticipated and wrote down?
- Collect the new information from the entire school and/or from the class in a presentation. Make pie charts or histograms.
- The results can be presented before an actual audience, for example pupils at the same class level, teaching staff or a parent-teacher meeting.

#### Explain:

- The pupils explain and make the case for the results shown in their survey.
- What might the reasons be for these being the most predominant bicycle accidents? The teacher can contribute expert knowledge.

- What measures can the individual pupil initiate, and what can the school/community do to reduce the harms from cycling accidents? The teacher can contribute expert knowledge.

#### Elaborate/extend:

- An extension of perspective might be to examine framework factors, for example the following aspects that we know about typical bicycle accidents:
  - Tipovers
  - Slides on gravel or slippery surfaces
  - Things in the wheel spokes
  - Running into obstacles
  - Losing balance
  - Being unable to stop before hitting an obstruction
- Elaboration might be to look more closely at behaviour change: where do we choose to cycle; what is dangerous about carrying more than one person on the bike, etc.
- Can this knowledge that the pupils have acquired contribute toward any improvements in the municipality where they ride bicycles? What can be done? Contact the municipal authorities and present the results? Write in the local newspaper?

#### Evaluate

Evaluation is placed in the centre of the model because it should be included in all phases of the learning process. We talk about formative and process assessment and summative or impact assessment. In addition, the pupils themselves must be trained to be able to evaluate their own learning. This can be done in many different ways, but it would be too detailed to go into this here. In general, however, it is a matter of the individual pupil and the class as a whole, along with their teacher, evaluating the methods, data and conclusions. Could we have done something differently? Did we get answers to the questions we posed through the methods we chose to use? Are there any uncertainties or sources of errors in the collected data? What kinds of conclusions can we draw? Are they in conformity with other knowledge we have collected from statistics? We shall continue with the same example in Chapter 4 on evaluation.

### METHODS TO MODIFY BEHAVIOUR AND CONTRIBUTE TO LEARNING

There are a number of suitable methods for working to modify behaviour, knowledge and attitudes.

We choose here to demonstrate three examples: the first is 'nudging'; the second is the use of concept cartoons/dilemmas, and the third is value clarification/active choice of values. Nudging can be a trigger and a factor that directly influences behaviour and habits. The other two represent tasks in which the pupils participate actively and relate to themselves, which may bolster personal cultivation and provide long-lasting learning.

#### Nudging

One method that has existed for a long time but that is increasingly being used systematically to modify behaviour is 'nudging'. The term is synonymous with 'shoving' and means gently urging people to go in a certain direction without their having given any special thought to the reasons for the change. Instead, people simply do something more or less unconsciously. Behaviour modification occurs without having to coax people with a reward or threaten them with a penalty. A common illustration of nudging is the mother elephant who nudges her offspring in the right direction without the baby elephant needing to know the reason why.

In daily life, we often do things without actively reflecting over what we do. Therefore, this is the primary area of application for nudging. Nudging is most effective under circumstances that are perceived as legitimate, that is, when it helps people do what they actually want to do, or when it is so subtle that it is practically invisible. A problem with nudging, however, is that individuals also adapt and change their behaviour in conjunction with other factors around them. Thus, it is difficult to be certain about how different individuals or groups of individuals are affected by nudging measures. Consequently, for nudging to succeed, the behaviour that one wishes to change must be very well understood, that is, there should be a problem analysis as described in the comprehensive model for behaviour modification, MAP, in Chapter 2.

We normally describe four different strategies for nudging:

- Change so-called standard alternatives. If people had to actively refuse to donate organs, it is probable that more people would donate organs. Likewise, there would undoubtedly be fewer registered church members if one had to actively enrol to become a member.
- Simplify and frame information. For example, colour labelling for tyres, displays with feedback

on the speed you are travelling, streamlined messages in campaigns.

- Change the physical environment, for example change the layout and functions in the road environment using lines; post signs to show where one should be; give reminders and warnings signalized by coloured asphalt etc.
- Familiarize people with social norms – this is how others behave, this is what the majority do, this is how role models act. As an example, show a celebrity using a helmet, a celebrity who never drives under the influence of alcohol, reflect over the social consequences of exceeding the speed limit, not using a seat belt.

One of the better known examples of nudging, at least among men, is the practice of placing a stick-on label of a fly on the inside of the urinal in the local pub. This resulted in an increase in cleanliness and a dramatic decrease in the amount of urine on the floor around the urinal.

#### Concept cartoons

Concept cartoons are cartoons that contrast differing points of view. The situations are taken from day-to-day life, experiments or natural phenomena. By visualizing ways of regarding given situations, the situation is problematized and the pupil is stimulated to further develop ideas. Concept cartoons are intended to create discussions and stimulate argumentation and critical thinking. Concept cartoons are a unique approach to teaching, learning and evaluating. You can find examples of concept cartoons on the following website: <http://www.naturfag.no/artikkel/vis.html?tid=1250350> and an example of the greenhouse effect here: <http://www.naturfag.no/grubleoppgave/vis.html?tid=2153665>

Concept cartoons do not necessary have a single correct answer. In many cases, the only reasonable answer is: 'It depends on...' When they are examined closely, even apparently simple situations may prove to have a number of potentially complicating factors in them. Concept cartoons can be used in many different situations and in many ways. It is also possible to write statements as the basis for creating debate and argumentation and to stimulate pupils to think critically.

#### Examples of statements:

##### Cycling on the pavement

- You can always ride your bicycle on the pavement.
- It is not permitted to ride a bicycle on the pavement.
- It is only permitted when there are few people on the pavement and it does not inconvenience pedestrians.
- It is only permitted when pedestrians say it is OK.

##### Cycling and traffic signs

- You must always obey all traffic signs when you ride a bicycle.
- You need to obey signs only when there is a bicycle pictured on the sign.
- You do not need to obey traffic signs when you are riding a bicycle.
- Only blue traffic signs count for bicycle riders.

##### Through these types of tasks we can

- make the pupils' notions and understanding more explicit.
- challenge and develop the pupils' notions and understanding.
- illustrate alternative viewpoints.
- stimulate pupils to develop arguments and to debate.
- help students to pose their own questions.
- have a point of departure for starting surveys.
- promote participation and bolster motivation.
- apply theoretical explanations in day-to-day situations.
- have a basis for differentiation.
- promote language development and understanding.

#### Clarification of values/active choice of values

Clarification of values or active choice of values are appropriate to teaching that pertains to connections between attitudes, interests and actions, in other words, a method that can be useful in teaching about traffic and traffic safety. Through clarified values, we can provide the pupils with training in expressing themselves orally and in writing; we can teach them to find knowledge as a basis for their own opinions and give them practice in upholding them. Active choice of values means to:

- make conscious choices based on a consideration of various alternatives and consequences.
- make choices we are satisfied and proud to have made and that we are willing to tell others about.
- make decisions that we act in compliance with and frequently repeat.

The objective is not to teach specific values, but to train the pupils to become proficient in evaluation processes. You can find some examples on the website naturfag.no under the heading Verdiklargjøring (Clarification of values).

##### Example: Cycling with a helmet

You are going on a bicycle trip and one or several of your mates choose not to wear their bicycle helmet.

- What do you decide to do? What arguments will you use to justify your decision?
- What might the consequences of your decision be?
- What other strategy could you have chosen to solve the issue? What arguments would you have used in this case?

#### Role play and reflection

Role play is an appropriate method for highlighting different arguments that can be used in various traffic situations in addition to creating variation in teaching. Let the pupils present arguments or reflect over a given standpoint or assertion.

Examples:

- I can easily rid myself of a bad habit I might have when I ride my bicycle.
- It is OK to use my mobile phone while I am cycling.
- It is your duty to tell someone if a driver uses his/her mobile phone while they are driving.
- It is OK to cross the road when there are no cars in sight and the light for pedestrians is red.



## Chapter 4

# EVALUATION OF TRAFFIC SAFETY MEASURES

In the preceding chapter, we have presented a model showing the factors that influence people's behaviour generally (Chapter 2) and in traffic specifically, and we have presented educational models and principles for how to proceed when the objective is to affect cognition and behaviour (Chapter 3).

In this chapter, we will present principles and examples of how we can evaluate measures we implement to influence attitudes, behaviour and safety. It is important to evaluate these measures for several reasons. The most important and most obvious, of course, is to document that implemented measures work, so that our efforts are not in vain. It is wasteful to spend resources on things that do not work. It is also important, however, to ascertain why measures are successful or unsuccessful, how measures can be improved and which recommendations and warnings we might offer other people who want to try similar methods. To be able to have confidence in the outcomes of evaluated measures, it is crucial that the results be based on acknowledged scientific principles.

Many programmes designed to persuade young people and others to behave more safely in traffic have proved not to yield the desired outcomes. The reason of course may be that the measures were not effective, but it might also be due to methodological problems that render it difficult to prove effectiveness on scientific grounds. The objective of this chapter is to elucidate some of the methodological issues linked with both impact and process evaluations of many of the measures targeting children and adolescents. Our purpose is also to provide tips and guidance on how we can solve these issues so as to be able to draw relatively reliable conclusions when the measures are evaluated.

### IMPACT EVALUATION

Impact evaluations are conducted to document whether measures work. A basic requirement for an impact evaluation is that the changes we find evidence for are not due to chance, but can be attributed with a high degree of probability to the measure we have implemented. It is at this point that the first challenge arises. To be able to demonstrate a change, a high degree of statistical power must be present in the evaluation. In practice, this entails that the measure must have a sufficient sample of participants and/or sufficiently long follow-up time so that any detected changes are clear and reliable. A single change in a small group from one point in time to another may derive from pure chance. If, on the other hand, a change occurs among many persons who have been subject to a measure, we can conclude with a high degree of confidence that this is not due to pure chance.

Another requirement to ensure that a change is attributable to a measure is that we must have a control group that has not been subject to the measure in question. If we find a change in an experimental group (the group subject to the measure) that is sufficiently significant, while at the same time we do not find such a change in the control group (which is not subject to the measure), we can be reasonably certain that the measure has been effective.

The number of people needed in a sample depends on what we wish to measure and the impact and magnitude of the changes that we wish to prove. If we want to see impact in terms of number of accidents or number of injuries or fatalities in traffic, we will need large sample groups, but if we are content with demonstrating changes in behaviour, we will not need as many people. For example, if we want to prove a reduction of 10% in the number of (self-reported) accidents as a result of a measure targeting young, novice

## ■ Evaluation of traffic safety measures

drivers from one year to another, we will need about 4000 drivers divided between an experimental group and a control group, both of which are followed up for one year after implementation of the measure. This estimate is based on surveys showing that 30–40% of novice drivers report at least one accident in the course of the first year they have a valid driving licence.

If instead of using self-reported accidents, we want to use insurance companies' data on accidents (about 15% of novice drivers have these accidents), we will need a sample of nearly 20,000 persons. If we want to assess changes in accidents involving personal injuries based on police reports, we will need more than 200,000 to demonstrate a 10% change in the number of accidents. The reason why so many drivers are required is that accidents of this kind only occur among 1–2% of the novice drivers in the course of the first year they have a valid driving licence. The more frequently an effect occurs in a group, the fewer participants we need to prove impacts. It is also true that if we are satisfied with showing only very large changes, for example a 50% reduction in the number of accidents, we need a far smaller sample than when we want to show minor changes with statistical reliability.

In many cases when we implement measures targeting specific groups, we do not have enough persons to enable us to measure effects on accidents and injuries, but in some cases, official accident data can be used. The 'Speak up' (Si ifra) action, for example, was implemented in a number of Norwegian counties, and researchers were able to evaluate its impact by using the trends in accidents reported by the police in counties where the action was held, compared with counties that had not implemented the action (Ulleberg and Christensen, 2007).

In recent years, the matter of so-called evidence-based methods has become increasingly relevant. Evidence-based methods involve researchers acquiring scientific documentation that a measure causes the outcome they wish to achieve, that is, that an impact evaluation is conducted as described here. In traffic safety work, this has frequently been synonymous with demonstrating a reduction in the number of accidents, fatalities or injuries. The Norwegian Institute of Transport Economics (TØI) synthesises many studies of impacts of this kind in the 'Handbook of Traffic Safety Measures' (Elvik et al., 2009; Høye et al., 2012). The handbook is a good example of this kind of approach.

## TARGETED IMPACTS

As mentioned above, a very large sample is required to prove the impact of measures on accident rates. Very frequently, therefore, so-called indicators are used instead, that is, intermediate factors that we know are correlated with accidents. For certain of these indicators, the connection with accidents is so well documented that we have no problem replacing accidents, as an outcome, with this indicator. These indicators are often called 'risk factors', that is, factors that we know increase the likelihood of accidents or injuries. An example of an established indicator or risk factor of this kind is speed; it is very well documented that higher speed results in a higher accident rate and more serious accidents. The extent of changes in accident rates and injuries deriving from a given change in speed is also well documented (Elvik 2013). Being able to show changes in speed is therefore a reliable indicator that enables us to calculate changes in both accident rates and injuries.

It is very common to use such indicators as targets for traffic safety promotion. The Norwegian Council for Road Safety, for example, works to persuade children and adolescents to use reflectors, bicycle helmets etc. based on an assumption that it has a significant effect on the number of accidents and injuries. The model for behaviour modification presented above also has an implicit assumption that certain types of behaviour have an effect on accident rates and injuries. One advantage in using behaviour as a targeted impact is that we can evaluate measures with far smaller sample populations than we would need to measure the direct effects on accidents and injuries.

The other requirement to impact evaluation, the fact that we need to have a control group, is nevertheless just as important regardless of whether we use behaviour modification or other measurements of impact. An example can illustrate what this entails. The Norwegian Public Roads Administration has conducted a seat belt campaign over a period of several years in which the message has been posted in the form of a large sign along the roads picturing an adult and a child, and the child's arm symbolises a seat belt, cf. Figure 4.1.

Seat belt use in Norway has increased in recent years and is now far above 90%. It is easy to assume that this is due to the seat belt campaign. However, strictly speaking, we cannot know this.



Figure 4.1: Campaign sign for the Norwegian Public Roads Administration's seat belt campaign.

It turns out that seat belt use in recent years has increased most in densely populated areas. The campaign sign is posted on country roads/motorways – in other words, not in densely populated areas. The reason for the increase during recent years may very well be that increasingly more cars have seat belt reminders, and this is what has been effective.

To find out whether it was the seat belt campaign that had the intended effect, we should have first performed a pre-assessment and observed the use of seat belts in two different areas, for example in two counties over a defined period. Following that, the campaign sign should have been posted in locations in one of the counties. Next, to investigate impact, we should have surveyed the use of seat belts in both counties after some weeks had elapsed (and perhaps again after a couple of months to discover whether any detected changes had prevailed over time). If seat belt use had increased in the county where signs were posted, but not in the county lacking signs, then we could assume that the seat belt campaign had been effective (provided that other things had not occurred at the same time that might have influenced the use of seat belts and that were different in the two counties). This kind of evaluation was not conducted in the NPRA's seat belt campaign; therefore, it is difficult to know whether the sign has had any effect.

One example from the use of this kind of evaluation scheme is an assessment of the 'Share the road' campaign commissioned by the NPRA and conducted

## ■ Evaluation of traffic safety measures



Figure 4.2: Campaign sign for the NPRA's 'Share the Road' campaign.

by the Institute of Transport Economics (Høye, Fyhri and Bjørnskau, 2016). A pre- and post-survey with a follow-up control was used to ascertain whether the campaign sign promoting better cooperation between cyclists and motorists had any effect. Evaluation schemes of this kind are normally called 'experiments' in the methodology literature.

The campaign sign was placed in two locations in Maridalsveien in Oslo, while Sørkedalsveien in Oslo was used as a control stretch of road (not signposted). On both stretches, cyclists and motorists were interviewed about cooperation between them, 'the right to the road', self-reported behaviour etc. before and after the posting of the signs in Maridalsveien. The outcomes showed a marked improvement in self-reported behaviour, in perceptions of cooperation between cyclists and motorists, and in the notion of right to the road etc. in Maridalsveien between the period prior to posting the sign and after it was posted. There was no change in Sørkedalsveien. The campaign sign and its placement are shown in Figure 4.2.

Practices vary somewhat in different disciplines when it comes to evaluation methodology, and researchers do not use this kind of experimental scheme to study impact in every discipline. In some of the social sciences such as education, these methods are used to a lesser extent when compared with medicine and psychology, for example. In some cases, it may also be difficult to apply experimental schemes like these, if, for example, one is trying to gradually influence people over a longer period of time, which

is largely the case in school. In a lengthy course of time, there are many factors influencing children and adolescents, and it may also be difficult to specify what 'measure' is to be implemented and ascertain when we can expect an effect. In these cases, it is important that projects and teaching plans be based on prior research pertaining to learning, preferably based on previous impact evaluations; see Chapter 3.

#### What kind of behaviour is a risk factor?

In many of the cases in which established indicators are used, such as those involving speeding, we can be relatively sure that a change in indicator will result in a change in the accident rate. In many cases, however, indicators are used where the connection to accidents is merely assumed. We actually know very little about the connection between risk of accidents and indicators such as knowledge about risk, attitudes towards traffic safety or social norms and peer-group pressure among adolescents.

In terms of the connection between attitudes and behaviour, there are several scientific theories concerning how these connections appear, for example, Fishbein and Ajzen's theory of planned behaviour (Ajzen 1991) and our own behaviour modification model that we describe in Chapter 2. Research is being conducted in many areas in order to enhance this knowledge. There are also several measuring instruments, tests and questionnaires that have been developed as standard methods for certain measures, for example a British battery of questions for motorists, 'Driver Behaviour Questionnaire' (DBQ) (Reason et al. 1990). Even though in many cases we do not have a great deal of knowledge about whether certain types of behaviour are risk factors (cf. the discussion about whether persons with ADHD are more risk-prone than others, or the debate about how dangerous cannabis is), we do have very good documentation in many cases of the connection between behaviour and accidents.

It is very well documented, for example, that so-called 'violations' in the DBQ (i.e. deliberate rule-breaking) are associated with increased involvement in accidents. It is also well documented that speeding while under the influence of alcohol, seat belt use, collision safeguards etc. are correlated with accidents and/or the scope of injuries. The Handbook of Traffic Safety Measures provides a broad view of how a range of measures/indicators are correlated with accidents and injuries.

The fact that a child possesses traffic knowledge and

skills may also be an indicator of good safety. One example of an impact evaluation where an indicator like this was used is the trial road-user training conducted for six-year-olds at two schools with the aid of a physical tabletop model (Fyhri et al. 2004). An experimental group received training and was compared with a control group that had not received training. The children in both groups walked a determined route around their school before and after the experimental group was given training with the tabletop model. When the children then negotiated traffic, they demonstrated and told an adult accompanying them where and how they intended to cross the road etc. In this trial, the children's behaviour (and explanations) were used as indicators of a safety effect. This trial is described in more detail in the next chapter.

### STRONG AND WEAK TARGETED IMPACTS

A number of different impacts can be subject to measurement – both final outcomes, such as fewer accidents, and intermediate indicators. NTR (2007) has grouped targeted impacts into the following three types, depending on the level of quality they have in mind in terms of the final underlying outcome for all measures, i.e. improved traffic safety.

#### TYPE 1

Evaluation of the content and methods of the measures, for example:

- Have people become aware that the measures exist?
- What do people think about the system/course/measure?
- Are people satisfied?

Studies of this type provide a minimum of information about the measure. For example, if no one in the target group has discovered that there is a public awareness campaign targeting them, then it is obvious that the measure has been unsuccessful. Surveys like Type 1 can provide important information for a process evaluation (why did things go wrong?) and are therefore useful even though they lead to no conclusions about the effects of traffic safety in and of themselves. Surveys like Type 1 are thus a weak evaluation measurement.

#### TYPE 2

Measurement of the ways in which a measure such as a training course has been effective, for example:

- Attainment test. What have people learnt?
- Have people's attitudes been modified?
- Have people changed their intentions?

In this type of evaluation as well, we do not measure the effects on behaviour or accident rates or injuries, but instead what we assume may be important indicators or intermediate variables. As mentioned above, there is no existing documentation on the connection with accidents for all indicators that are used, and it is uncertain, for example, that more knowledge about risk yields safer traffic behaviour. However, we are able to claim that changes in knowledge, motivation and attitude are necessary, albeit insufficient, conditions for changes in behaviour to occur. Therefore, Type 2 surveys are not strong outcome measurements, but they are stronger than Type 1.

#### TYPE 3

Evaluation of the impact of the measures, for example:

- Have people changed their behaviour?
- Has there been a reduction in law violations or misdemeanours?
- Has there been a change in the number of accidents or injuries?

Studies of Type 3 have the most stringent criteria since they show whether the ultimate targets of a traffic safety measure have been achieved. As previously mentioned, it is frequently demanding to measure changes in accident rates and injuries, and it can also be very difficult to obtain good data on changes in the number of law violations/misdemeanours. In terms of observable behaviour, however, it is often very simple to measure changes. For example, it is easy to ascertain whether the use of bicycle helmets or reflectors has changed as a result of a measure, and this is often much easier than trying to discern changes in motivation and attitudes.

As a rule of thumb, we might say that the closer we come to the ultimate objective of a measure of which we are assessing the effects, the more certain we can be that a change has actually influenced the final objective. Studies like Type 3 assessments are therefore the strongest evaluation measurements. If we have an opportunity to measure effects at several points in time after implementation of the programme, we get a further strengthened measurement of impact.

### PROCESS EVALUATION

The most important aspect in an evaluation is normally what kind of effect a measure has had. In addition, we are frequently interested in the process that led to the effect, or why a measure was not effective. Along with conducting impact evaluations, it is also useful to evaluate the process behind the measure. Through such process evaluations, we can acquire better knowledge about the mechanisms that have facilitated the resulting impact.

Again, the 'Share the road' sign can serve as an example. Through questionnaire surveys distributed to motorists and cyclists, it was documented that both groups felt that cooperation had improved during the post-campaign period on the stretch of road where the signs were posted. Moreover, the questionnaire contained some questions about both the road user's own behaviour and about how they perceived other people's behaviour; the road users, in their answers to both types of questions, felt that the situation had improved. This suggests that the sign may have served as a reminder about 'how we should behave' with which most people actually agreed. The fact that the sign was large and highly visible and placed on a stretch of road where there had been problems in the interaction between cyclists and motorists was undoubtedly an important aspect in this process. More than 70% of the cyclists, and more than 60% of the motorists had seen the sign. Doubtlessly, if fewer people had seen the sign, the impact would not have been as large.

The location of information in the form of a highly visible sign on the roadside is based in part on the outcomes from the comprehensive EU project 'Campaigns and Awareness Raising Strategies in Traffic Safety' (CAST) (Forward & Kazemi (eds.) 2009). A large amount of literature about campaigns and information measures in the field of traffic safety was reviewed in this project, and it was concluded, among other things, that if the message is to reach the recipients, it is important to impact the target group and the activity that one wishes to change. The sole use of mass media (TV, radio and newspapers) is generally ineffective.

#### Process objectives:

The final goal of a traffic safety measure is always to reduce or limit the scope of accidents and injuries. We are frequently unable to measure this in terms of accidents and injuries and instead use indicators, and we often know from experience (e.g.

## ■ Evaluation of traffic safety measures

prior evaluations) that the measure must be implemented in certain ways and must have a certain scope and duration to be successful. The issues are how best to reach the target group, which channels we should use to influence them, which measures and combinations of measures will be most appropriate, etc. Based on established knowledge about how we can best reach the group we wish to influence, we can then define a number of process objectives that we should satisfy in order to succeed. If we want to reduce moped engine boosting among teenagers, for example, we might consider the following process objectives:

- Run a training course for a certain number of adolescents in a school or youth centre.
- Conduct a practical, insight-based risk course with these adolescents.
- Convene a certain number of meetings/discussion sessions with parents.
- Meet a certain number of authorities (police, school administrators, municipal politicians, sports managers etc.).
- Identify how many moped dealers offer help to boost moped performance.
- Write a certain number of articles in the public media.

The process evaluation may be important for our understanding of why the desired impacts were achieved or why we failed. Perhaps we have used the wrong channel of communication and failed to reach our target group; perhaps the message or the training was not understood etc.

It is nevertheless important to remember all along that to measure what we wish to achieve, such as reduced moped engine boosting, for example, we must then also conduct an impact evaluation; we must be able to document that there are actually fewer moped drivers boosting their moped engines after the measure was implemented. It is frequently tempting to content oneself with pure process objectives because it is easier to achieve and document that predetermined process objectives have been accomplished.

## TARGETS AND MEASURES

A measure implemented to enhance traffic safety should always be based on a problem analysis. What are the safety problems, for example, that fifteen-year-old boys have in traffic? We note, for example, that they are overrepresented in moped accidents, and we decide that we should do

something about this. An in-depth analysis of their accidents reveals, for example, that the moped accidents that occur mainly involve mopeds with boosted engines. The more detailed and in-depth we go when studying the problem, the more precisely we can design our intervention.

A traffic safety measure always has the targeted impact, explicitly or implicitly, of reducing accidents or injuries. This type of goal can be called overarching, but it often helps us only to a limited extent in terms of deciding what we actually plan to do. To be more specific, we need to define subsidiary objectives that are based on the problem analysis that we have conducted. When it comes to moped accidents, it is a matter of defining the target group as 15-year-old boys riding mopeds and then designing subsidiary objectives for reducing moped engine boosting. This is the point when the discussion on indicators comes in, along with the need to decide for which indicators we need to specify targets. Can we set targets for fewer accidents? Or, because of the nature of the problem and the size of the target group, should we select targets linked with one or more indicators? Do we also want to include indicators enabling a better understanding of the nuances of effects that we may discover?

In this example, the problem analysis may show that accidents cannot possibly be used as a measure of impact because the group we will be working with is too small (too few accidents). However, the problem analysis might also have shown that the target group possesses insufficient knowledge about how dangerous it is to drive mopeds with boosted engines, and that they are not aware that boosted engines may result in a postponement of their eligibility to qualify for a licence to drive a motorcycle or a car. Perhaps they also have a positive attitude towards engine boosting and driving too fast because they (wrongly) believe that girls are impressed by that kind of behaviour. Moreover, studies have demonstrated that many parents know that their children have driven mopeds with boosted engines but have done nothing to prevent it. It is also a known fact that certain moped dealers actually help their customers boost the moped engines if they want to. We can formulate the following indicators and subsidiary objectives based on a problem analysis like this:

- Increased knowledge among young people, parents and moped dealers about the risks of driving at high speed with a moped with a boosted engine.

## ■ Evaluation of traffic safety measures

- Increased knowledge among young people and parents about the legal consequences of being nabbed with a moped with a boosted engine.
- Changed attitudes among adolescents towards boosting moped engines.
- Increased intervention by parents to prevent adolescents from driving mopeds with boosted engines.
- Fewer moped dealers who offer help in boosting engines as a service to customers.
- Reduction in the number of mopeds with boosted engines in the target group.

The subsidiary objectives should be quantified if possible. When we have precise objectives, it is easier to ascertain whether or not we have achieved an impact when we conduct the evaluation, cf. the list of possible process objectives on the preceding page. Without going into how we actually implement the measures, the list shows a number of specific subsidiary objectives that are relatively easy to measure. Knowledge, attitudes and parental intervention can be measured through the use of questionnaires. The scope of engine boosting can be measured in collaboration with the police or the Norwegian Public Roads Administration by stopping and inspecting mopeds in traffic.

The more clearly the targets are stated, the easier it is to carry out an evaluation. It is also necessary, in addition to establishing clear targets, to plan the evaluation before the measure is implemented so that we can ensure pre-measurements in both the experimental and the control group.

Generally good opportunities exist to evaluate traffic safety measures targeting children and adolescents through both impact and process evaluations. It is important to conduct such evaluations in the interest of learning and of the best possible utilisation of resources. It is also important that we try to conduct evaluations even though we are unable to satisfy all requirements for pre- and post-studies with control groups.

## EXAMPLE OF USE OF THE MODEL - EVALUATION OF SAFE BICYCLE USE

We shall end discussion on this example by applying the Trygg Bruk av Sykkel (Safe Bicycle Use) model that we began in Chapter 2 and continued in Chapter 3. A simple formula for an impact evaluation might be to investigate whether pupils who

have received training have changed behaviour towards being safer in traffic than another group that has not received the same training. Let us assume that two or more schools have faced the same safety issue. We survey two schools at the beginning of the month of May to ascertain how the pupils use their bicycles:

- We observe how they ride their bicycles to and from school before receiving training.
- Use of bicycle helmet/lights/reflectors.
- Crossing roads (with or without traffic lights)
- Signalling and positioning on roads/bicycle paths/pavement.
- We design a questionnaire for the pupils about how they ride their bicycles and about their knowledge and attitudes towards traffic safety, focusing in particular on safe cycling.

After the pupils at both schools have been observed during a preliminary period and have answered the questionnaire, we conduct the 'Safe Bicycle Use' programme at School A during May. At School B, nothing like this occurs during the same period. We subsequently repeat the measurements, both observations and questionnaire, in a post-period – for example in mid-June, and perhaps again at the start of school in August. If we find that the pupils at School A have changed their behaviour towards better traffic safety, as measured through both observations and the questionnaire, we can conclude that the 'Safe Bicycle Use' programme very likely has had an impact.

In addition to measuring impacts, we should also evaluate the process, including the scope and content of 'Safe Bicycle Use' at School A, how the teachers and pupils (or parents, when included) found that the training worked, whether there were aspects of the intervention that did not work well, etc. Another option here is to supplement the questionnaire that was given to pupils in School A in the post-period with questions pertaining to their points of view and perceptions of the training.



## Chapter 5

# BEST PRACTICES – WHAT DO WE KNOW ABOUT WHAT WORKS?

In this chapter, we shall consider some of the things that we know work when it comes to the Norwegian Council for Road Safety's (NCRS) core areas: attitudinal development, information campaigns and education and training. We present the best practices in these areas, and we discuss issues associated with the evaluation of promotional efforts and education and training programmes. The model for behaviour modification that is presented in chapter 2 shows important factors that have an effect on road-user behaviour, and which are therefore of key importance with regard to the testing and evaluation of programmes. The 5E model that we have discussed in chapter 3 has been assessed to be a key factor in all planning of instruction and implementation of education and training programmes. This is crucial in order to ensure quality in the planning of the programmes and to obtain knowledge about whether or not the education and training work. Therefore, evaluation is given a key role in the graphical model. Evaluation involves both the actual teaching process and its outcome or impact; i.e. whether the desired learning outcomes are achieved.

As noted in Ch. 4, many programmes designed to influence children and adolescents to change their attitudes and behave more safely in traffic have not been able to give the desired outcomes. The reason may obviously be that the programmes have not been effective, but it may also be attributed to methodological challenges. In addition to presenting examples of good practices, another objective of this chapter is to call attention to some of the methodological problems that are associated with both the impact and the process evaluation of many of the programmes aimed at children and adolescents. The objective is also to give tips and guidance about how we can meet these challenges in order to arrive at relatively reliable conclusions

when the programmes are evaluated. In this review, we have focused in particular on NCRS's key target groups, which are children and adolescents aged 3-6, 6-12, 13-15 and 16-19.

### WHICH OF THE PROMOTIONAL AND ATTITUDINAL DEVELOPMENT EFFORTS WORK?

Promotional and attitudinal development efforts have been very frequently used to improve road users' attitudes and behaviour, both in Norway and elsewhere in the world. Unfortunately, very few studies have been able to document clear impacts of this. In many cases, effects on behaviour and/or accidents have not been investigated; e.g. people have merely examined whether a campaign has been noticed without using any pilot or control groups. When attempts at evaluation have been made, they have often not employed sufficiently good methods (e.g. only studies undertaken before and after the intervention, but without any control group).

#### **Collective or individual responsibility**

A general challenge that we can easily face when we try to change people to behave more safely in traffic is that almost everyone thinks they already behave responsibly and safely. It has traditionally been easy to gain political acceptance for various campaigns to improve safety, such as 'Aksjon bedre bilist' (the Better Motorist action) or 'Bilist 2000' (Motorist 2000), but one of the challenges in these campaigns has been that few people feel they are a part of the target group. Most people will probably agree that people ought to behave more safely and more responsibly in traffic, but very few will think that this also applies to them. A Swedish study from the early 1980s showed that almost all drivers regarded themselves as better than average

(Svenson, 1981). Therefore, many campaigns are thwarted by a kind of 'collective responsibility' mentality: people do not have any incentive to change their own behaviour: instead, it is other irresponsible people out there who need to change their behaviour.

For example, the Norwegian Public Roads Administration (NPRA) conducted a campaign against speeding a few years ago, where they tried to convince people that also those who only slightly exceeded the speed limit could suffer accidents because of that behaviour. However, this campaign probably failed because too many people think that it is others who need to be more careful. Many people think that 'After all, I have not had any serious accidents, so traffic safety will not be any better even if I drive 10 km/h slower'. Therefore, on a purely theoretical basis, there is reason to believe that information measures that improve the safety of the individual will probably have a much greater chance of succeeding. It is easy to find examples of this in practice – there is very great acceptance for implementing programmes to safeguard children in vehicles – and most people will change their behaviour if they are informed that they are doing this in the wrong way.

Likewise, the EuroNCAP system, which tests and ranks cars according to safety, has become very important in the marketing and demand for cars. People believe that they benefit from these safety programmes – they are good for the individual. The same logic should also apply to a number of other measures, e.g. use of bicycle helmets, but using them does not have the same degree of acceptance.

#### Intention – action

A second challenge that is important to be aware of when we are going to implement information measures and try to modify attitudes is that people may often want to change their behaviour to become safer in traffic, but do not succeed in doing so in practice. For example, this may apply to many adolescents, who are especially vulnerable or subjected to peer-group pressure. For instance, it is conceivable that many adolescents regard bicycle helmets as personally beneficial and would actually like to make use of them, but they don't dare to do so because of peer-group pressure. In general, it is well documented that there is often little correlation between intentions to perform a particular action and the actual behaviour; cf. the social

influence model, where factors such as social pressure and inability to realise intentions can help explain this. Recent experiments that involve teaching people to develop implementation intentions have shown good outcomes (Brewster et al. 2015) and may have a great potential among behaviour modification initiatives in the area of traffic safety.

#### Technical terminology and statistics

A third challenge that is deleterious to a number of information measures is that those who formulate the message are often apt to use their own jargon and technical knowledge, both of which function poorly when trying to communicate with the general public. In the area of traffic safety, this has meant that information has often been presented in the form of technical, physical and/or statistical truths that many people do not understand. What does it mean, for example, that 'the risk is reduced by X per cent if you cycle with a helmet' or that the braking distance increases with "the square of the velocity"? We try to modify people's knowledge (cf. the MAP model), but the message is often too technical for people to understand what it means. In addition, the knowledge that is sometimes presented may not provide any particular incentive to change behaviour to become safer in traffic safe. For example, a number of information measures contain purely factual information about the number of people who die in traffic per year, the number of people who ride a bicycle with or without a helmet, etc. For the recipient of this kind of information, it is not obvious how they should put this knowledge to use.

#### 'Triggers' as a supplement or alternative

A fourth challenge for information measures is that people are overwhelmed with information, and it is difficult to reach them with a message in today's media society. Those who conduct information campaigns can easily become extremely selective in their attention and think that far more people notice a campaign or the inherent information than is actually the case.

An alternative to information and attempts to modify attitudes may be to give away safety equipment either free or at an extremely reasonable price on the condition that people are obligated to use it. This kind of approach can be said to be an example of 'triggers' that are included in the model as a 'directly acting factor' that we have developed and presented in figure 2.7.5 in chapter 2. In this case, we do not enter into a process where the target

group is supposed to change its attitude and then its behaviour, but trust that there will be rather spontaneous behavioural changes through direct financial incentives. This has been used successfully with bicycle lights and bicycle helmets, and in both cases with very favourable outcomes (Nordbakke & Bjørnskau, 2006; Kazemi & Forward, 2009).

A campaign to promote the use of bicycle lights in Kristiansand, Norway was conducted as a 'light raid', where people who cycled in the dark without a light were stopped by the police and representatives from the municipality. Instead of being given a fine (fast-track hearing) for cycling without a light, they were given a bicycle light and an offer to buy a taillight at a reduced (half) price (Nordbakke & Bjørnskau, 2006). The above-mentioned experiment with a helmet was similar, but in that case, the cyclists had to sign an agreement to use the helmet in order to receive the offer (Kazemi & Forward, 2009).

For measures of this kind to work, it is probably a big advantage, or maybe a necessity, that they be combined with other measures. In Kristiansand, the cyclists were stopped by the police, which in itself can probably also act as a 'trigger' to cycle with a light. In the Swedish helmet campaign, they had to sign a binding agreement to use the helmet in order to receive the offer of a free helmet. If we merely give away safety equipment, such as reflectors, etc., it is probably less likely that we will get these outcomes.

#### It is a good idea to combine measures

The EU project "Campaigns and Awareness Raising Strategies in Traffic Safety" (CAST) reviewed a large amount of literature about campaigns and information measures in the area of traffic safety. Based on a meta-analysis of the evaluations of the individual campaigns, CAST concluded that these campaigns had favourable outcomes and reduced accident rates by an average of 9%. However, the extent to which the outcomes in the individual campaigns were due to the information measures alone is somewhat uncertain, as is the extent to which they were due to other initiatives implemented as part of the campaign – primarily police controls.

A large part of the total impact was a result of a number of effective campaigns against driving under the influence (especially in Australia), which combined the message of the campaign with more intensive police controls.

The CAST project concluded that the following factors are important for information measures and campaigns to have an impact:

- short duration
- message in traffic
- personal influence
- police control

As mentioned, the CAST study concluded that as a rule the use of mass media (TV, radio and newspapers) did not have any impact. They also found that recent campaigns (after the year 2000) could not demonstrate any statistically reliable outcomes. One possible reason for this slightly surprising finding may be that recent campaigns have been evaluated on the basis of stricter (better) methods than the older ones.

## EDUCATION, TRAINING AND INFORMATION TO CHILDREN AND ADOLESCENTS

Much of the attitudinal development that the Norwegian Council for Road Safety (NCRS) aims at children and adolescents is in the form of gradual measures implemented over a long period of time. There are major challenges associated with evaluating programmes that last a long time with many small factors influencing behaviour. To meet the requirements regarding evaluation in such cases, we may initiate a new measure or make use of new educational material in some parts of the country and use other areas as a possible control. Among other things, NCRS has wanted to conduct initiatives targeting certain groups in order to achieve specific goals in a relatively short time horizon. For example, the organisation has implemented education programmes and information measure such as 'Ikke tøft å være død' ('Being dead isn't cool.'), 'Jentenes trafikkaksjon' (The girls' traffic action), 'Ungdomsskolepiloten' (The lower secondary school pilot project), etc., all of which have been programmes implemented over a limited period of time. Most of these programmes have also been evaluated in keeping with the ideal of having preliminary and post-studies with control groups.

There are many empirical examples that education and training can improve children's knowledge about and attitudes to traffic. There are fewer examples where the education and training has a lasting impact on the children's behaviour. There is some documentation that education and training can reduce accident rates. In particular, "communi-

ty based programmes,” where education and training have been one of the elements, have resulted in a reduction in accident rates.

#### Systematic, specific and well-founded

One distinguishing feature of the studies that have been most promising with regard to inducing behaviour modification is that the education and training has been systematic and carefully thought out. In addition, its content is important: a necessary condition for successfully educating and training children is that through specific procedures for influencing behaviour, the children shall develop an understanding of why something is dangerous and why they should act in a particular way. The form that the education and training should take is essentially a question of available resources, but there are many indications that the most common and least resource-intensive form, i.e. education in large classes, does not result in any measurable change in behaviour. As with other education, it is more effective to work in small groups (5-7 pupils). The closer the actual traffic situation in which the children are trained, the greater the chances for succeeding (engaging them).

#### Engagement, self-determined activity and guidance

All forms of successful education and training require that the children are challenged to arrive at solutions themselves (research and explanation). This does not mean that the children should learn to understand traffic on their own; children are dependent on support and explanations from an adult. This is supported by research, which also emphasises the importance of adjusting the way that the children are instructed and taught in accordance with each child's specific level of knowledge about the relevant topic. We think that the use of the 5E model in planning and implementing the education and training must take into consideration the above-mentioned points and that this will provide greater opportunities for achieving quality and desired results in a training programme.

One of the most thorough and most well thought out of the studies in this area was conducted by educators (Tolmie et al., 2005). They concluded that

- The key to successful education and training is the development from procedural strategies to an understanding of 'why' (more generalised knowledge).
- Education methods that support conceptual development will have a greater impact than pure

“behaviour copying”. More specifically, education and training where the adults support a social interaction among age-group peers will be extremely fruitful.

An important implication of this is that training must not necessarily take place in traffic in order to be effective even though this is the ideal. As long as the education and training maintains the requirement of an increased conceptual understanding, it may be conducted with the aid of computer simulation, for example, (which will often be more practical) and models.

Since the school and the day-care centre are the natural arenas for education and training of this age group, it can be interesting to consider the existing experiences regarding increased support of traffic education in schools. Experiences from Norwegian and Danish studies show that, in addition to the usual school subjects, topics such as traffic safety have to compete with a number of other good objectives to gain acceptance in schools and that this can be perceived as a barrier.

There are some important necessary conditions at the systemic level in order to succeed in getting across the message in schools:

- The activities must be incorporated into the school's local curriculum.
- The activities must be adapted to local conditions.
- The activities must have a basis of support in the administration
- Cooperation for the exchange of ideas and inspiration must be established among schools.
- Resources (time and money) must be provided, if for no other reason, then as a carrot.
- The teacher must find the right balance between pre-prepared lesson plans and personal ownership of the topic.

#### EDUCATION, TRAINING AND INFORMATION TO SMALL CHILDREN AGED 3-6

The Handbook of Road Safety Measures (Elvik et al. 2009; Høye et al. 2012) presents the following main challenges involved in teaching small children road traffic safety behaviour:

'In order to work as intended, education and training programmes for small children must be

adapted to the children's capabilities of learning. That means that theoretical and abstract words and concepts must be avoided; practical drills must be conducted in the places that the children frequent daily, where they can practice the things they have learned; the behaviour that is to be taught must not be too complicated and preferably not entail that several things must be done at the same time. Education and training programmes for pre-school children shall:

- influence the children's behaviour so that their accident risk as active road users is reduced
- give day-care centre staff and parents knowledge about the capabilities that children of different ages have for getting around safely in traffic
- motivate day-care centre staff and parents to improve children's safety, primarily through suitable education and training and the use of safety equipment.'

#### Outcomes of specific education and training programmes

The Children's Traffic Club was one of the first information and education and training initiatives that NCRS initiated. The Handbook of Road Safety Measures (Høye et al. 2012) notes the following about the impact of the Children's Traffic Club p. 620-621:

'The impact of the Children's Traffic Club on accidents has been studied in Norway by Schioldborg (1974) and in Sweden by Gregersen & Nolén (1994). The Children's Traffic Club in Sweden has been organised in the same way as in Norway and is administered by NCRS's sister organisation in Sweden, the National Society for Road Safety (NTF). The Norwegian study (Schioldborg, 1974) showed that children who were members of the Children's Traffic Club had an average of 30% lower health risk in traffic (accidents per 10,000 children per year) than children who were not members [...]. The study is debatable (Knudsen, 1975A, 1975B; Schioldborg, 1975A, 1975B). Membership in the Children's Traffic Club was voluntary. Therefore, the possibility cannot be discounted that the differences in risk arise because the parents of children who are members are more motivated to teach their children safe behaviour in traffic than the parents of non-members [...].'

The Swedish study of the Children's Traffic Club (Gregersen and Nolén, 1994) showed that children who were members of the Children's Traffic Club had an average 67% higher risk of being

injured in traffic per 100 hours spent in a traffic environment than children who were not members of the club [...]. Gregersen and Nolén discuss several possible explanations for this finding, but none of them have any empirical support. All in all, they conclude that the Children's Traffic Club in Sweden does not reduce the children's risk.

It is impossible to explain with any certainty why the results from these two studies are in such great disagreement. The conclusion is that measures such as the Children's Traffic Club can result in fewer accidents among children provided that their parents do not overestimate what the children are capable of learning, but that there is no guarantee that we will be able to achieve this kind of outcome. In another article that discusses the impacts of membership in the Children's Traffic Club (Elvik, 2003), it was also concluded that a change in the accident rate cannot be directly linked to membership in the club. It was underscored that increased knowledge among the children did not universally result in a lower risk of accidents and that there was no control for the amount of exposure to traffic in the study.

Bruce and McGrath (2005) conducted a study of the literature pertaining to studies of group-based traffic education for children aged 3 to 6. They found nine studies of the ways in which this kind of education affects knowledge, behaviour and/or attitudes. Five of those studies showed that the education had a positive impact on safety; three of the studies found mixed results, and one of the studies found that the education had no impact. None of those studies had examined the impact on accident rates.'

Vaa et al. (2012) cite the results from an American study where three different types of education and training of five-year-olds were conducted (Albert & Dolgin, 2010). All of the children were shown eight pictures of traffic situations with traffic lights, traffic signs, etc., the meaning of which was explained to them. Then one group was allowed to play and practice correct behaviour with the aid of a physical desktop model. A second group was read a story that included pictures of the correct way to cross a street, and a third group was taught a song based on the same eight situations.

The children were tested with the aid of pictures, dolls in the desktop model and actual street crossings. All of the groups scored better than a control group that

had not had any education and training, but only the group that had used the desktop model had a significant improvement in actual traffic.

The Norwegian Institute of Transport Economics (TØI) has conducted an education and training programme for six-year-olds (first graders in the USA, year-2 pupils in the UK) in collaboration with two schools, one in Oslo and one in an urban area outside Oslo in Eastern Norway (Fyrhi et al., 2003; Fyrhi et al., 2004). In this study, only the children who lived in Oslo were affected by the education and training. The researchers in the American study (Albert & Dolgin, 2010) concluded that all classroom instruction of this type may have an impact, but that it is the interactive play with a physical model that has the greatest impact (Albert & Dolgin, 2010). The Institute of Transport Economics concludes that the training must provide more than just simple instructions about what the children should do or rules of conduct in order to have any impact on behaviour, and this is also emphasised in the 5E model that was presented in chapter 3. In other words, in order for the education and training to work, it is a necessary condition that it provide the children with a deeper understanding of the dangers they may encounter in traffic and the type of behaviour that is adequate in order to avoid those dangers (Vaa et al., 2012). Based on these findings and on other literature about the traffic education of pre-school children, Vaa et al. (2012) list the following factors as important criteria for achieving modification of behaviour:

- Realism in the learning situation. The more realistic, the better. Actual traffic is better than a model for play, which is better in turn than a book.
- Explain why, not that. For instance, it is safe to walk on the sidewalk because cars are not allowed to drive there.
- Interaction with the digital learning aids. This makes it possible to challenge the children's knowledge, so that they get a deeper understanding of the whole situation.
- Repetition over a period of time. One exercise is not enough. Repetition is necessary.
- Specific learning outcomes. Click on this button. Stand on the curb.

These factors are in keeping with the 5E model. Realism in the learning situation will make it easier to engage the children's interest. Indeed, a key aspect in the 5E model is the importance of asking questions and providing explanations about why.

Interaction with digital learning aids is a type of research of the topic. Repetition over a period of time will help increase the learning.

## EDUCATION, TRAINING AND INFORMATION TO SCHOOL-AGE CHILDREN AGED 6-12

According to the Handbook of Road Safety Measures (Elvik et al. 2009; Høye et al. 2012), most of the education and training measures targeted at school-age children focus on crossing streets (pedestrians) and cycling. This is mentioned in the competence goals for Year 5 (UK = grade 4 in the USA) in primary school and Year 8 (UK = grade 7 in the USA) in lower secondary school.

In the USA, an information film about the correct way to cross a street was shown on children's TV at the same time as information materials were sent out to pre-schools and schools (Blomberg, Preusser, Hale and Leaf, 1983). Studies undertaken before and after the intervention showed that the measure gave a 10% reduction in accidents where children aged 5-9 suddenly dashed out into the road in front of a car. This measure was especially focused on this type of accident.

However, bicycle education and training does not seem to result in any statistically significant changes in accident rates (Høye et al., 2012; Elvik et al. 2009). The bicycle education and training involves teaching more general skills that are often more removed from the child's daily outdoor environment. This may be a reason why education and training of the correct way to cross a street seems to work better than bicycle education and training. However, several studies indicate that bicycle education and training increases children's knowledge about traffic safety (Hooshmand et al., 2014; Lachapelle et al., 2013).

It should be added that the vast majority of bicycle accidents are single-person accidents that are not usually registered in the official accident statistics. The reason for this is that the official accident statistics are based on accidents registered by the police, and most single-person accidents on a bicycle are not reported to the police. Therefore, it is possible that some impacts of the bicycle education and training are not detected in these evaluations.

On commission from the Norwegian Council for

Road Safety (NCRS), The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) conducted the study, 'Barn, sykling og oppmerksomhet' (Children, cycling and attentiveness) in 2015-16, which examined children's attentiveness while cycling (Moe & Roche-Cerasi, 2016). The aim of the study was to provide knowledge and understanding about children's control of their attentiveness while cycling. Through the use of a special camera, a Tobii Eye Tracker, they studied how children of ages 8, 9 and 10 orient themselves with their eyes as an indication of their attentiveness function.

This function of the brain has its own specific neuroanatomy and neural network, which communicates by means of special neurotransmitters such as noradrenalin, acetylcholine and dopamine (Posner, 2014; Amso & Scerif, 2015). The development of these networks and the effect of the neurotransmitters affect the attentiveness function and the capability of self-regulation during childhood and adolescence. This development concerns thoughts, emotions and actions. The key task of the brain and awareness is to know at all times 'where I am,' 'why I am here?', 'what I should do?', and 'what will be the consequences?'. This forms the basis for goal-oriented behaviour. Among adults, the orientation function and information control occur in separate neural networks, but in children aged 7-9, those networks are still integrated (Posner, 2014). This affects their ability to control their attentiveness and how easily their attentiveness can be distracted or diverted. The ability to suppress or ignore (inhibit) stimuli from their surroundings is therefore insufficient in these children. Many experiments have been undertaken to test the ability to inhibit behaviour (Jahanhahi, 2015).

In SINTEF's study (Moe & Roche-Cerasi, 2016), the children's ability to follow a plan while cycling was tested in a field study at the Eberg Traffic Model Facility in Trondheim, Norway. Their task was to respectively look at and avoid looking at a selection of stimuli in the surroundings in a GO/NO GO test. The children's basic skills on a bicycle were tested before the attentiveness study. These measurements showed that 40 per cent of the pupils failed the NO-GO test. This means that they did not manage to resist the temptation of focusing on distractions on the roadside. Nearly 100 per cent of the pupils manage to look at pre-determined stimuli in the GO test. These field tests thereby confirm the results from equivalent tests in the laboratory.

The results and the knowledge base in the Children, cycling and attentiveness study (Barn, sykling og oppmerksomhet) shall be utilised to develop and conduct some parts of the traffic education for bicycles, where teachers instruct their own pupils in special attentiveness drills in traffic situations. The pupils will be tested in a pretest-posttest study design in order to survey specific changes in behaviour. The final outcomes will be used in the further development of bicycle education and training and for information to teachers and parents.

## EDUCATION, TRAINING AND INFORMATION FOR ADOLESCENTS AGED 13-15

There have been many information campaigns and education and training programmes targeted at adolescents in the area of traffic safety, both in Norway and in other countries. In the period 2012-14, NCRS implemented the project Ungdomsskolepiloten (The Lower Secondary School Pilot Project). The project lasted for more than two years and had the objective of investigating whether pupils who had received traffic education through Ungdomsskolepiloten had acquired greater knowledge and changed their attitudes and behaviour when compared with pupils who had not received this kind of education and training. The project also investigated whether an education and training model focused on one topic has a greater impact than a model focused on four topics.

NCRS's efforts with Ungdomsskolepiloten were based on the principle of learning over a period of time, on parental involvement, on adolescent-to-adolescent communication and on activity-based learning. Three programmes with different topics were tested. 'Kunne det vært deg?' (Could it have been you?) focused on several topics (reflectors, helmet, seatbelt and speeding). 'Oppdrag reflekse' (Operation reflectors) and 'Oppdrag sykkelhjelme' (Operation bicycle helmets) each focused on only a single topic. The instruction was carried out in accordance with an experimental design where pupils in the pilot project and control schools answered questionnaires about attitudes to traffic safety and various measures prior to and after the instruction had been carried out at the schools in the pilot project.

The outcomes from Ungdomsskolepiloten for both years showed the same trend. Reflectors stood

out as a successful subject area, and here the Institute of Transport Economics (TØI) found both better knowledge about reflectors and “better” self-reported behaviour with regard to reflectors among those who had undergone the education and training programmes ‘Oppdrag refleks’ and ‘Kunne det vært deg?’ TØI did not find these changes in the other topics (seatbelt, speeding and bicycle helmet). Thus, the topic ‘Oppdrag refleks’ appears to have had an effect on the pupils, regardless of the education and training model.

TØI concluded that ‘Oppdrag refleks’ was effective because the information that was provided was “new” and was of practical use (the reflector is most visible when it is fastened to the leg at knee height). This was knowledge that most pupils were not previously aware of as opposed to the information that a helmet protects against head injuries. In addition, wearing a reflector is a simple task that is not very obtrusive. A reflector is far less socially visible than wearing a bicycle helmet.

An important insight from the research literature about campaigns and their impacts is that making use of information about what is normal (the social norms approach) can be very effective if the desired behaviour is quite normal, whereas the deviant behaviour is less normal than people think. This insight has been utilised in campaigns regarding driving under the influence, etc. (AAA-Foundation-for-Traffic-Safety (eds.), 2007) and is described in greater detail in the next section. When the adolescents in Ungdomsskolepiloten are given information that ‘only 40% of adolescents use a bicycle helmet’, we run the risk that the mechanism in the social norms approach will take effect, but in opposition to intentions. The adolescents are informed that the normal behaviour is to not use a helmet – in other words, if you want to be ‘normal’, you should not use a helmet. It is well-documented that social factors are extremely influential when it comes to the use of bicycle helmets; if your friends use helmets, you will be willing to do so as well (Lajunen & Räsänen, 2001; Nævestad et al., 2014).

It is also probable that it is more demanding to get adolescents to use a bicycle helmet than to use a reflector, simply because it is more of a fuss to put on a helmet every time (you can keep the reflector in your pocket). Wearing a bicycle helmet takes a greater effort and is more visible – and hence more vulnerable to social control.

‘Ikke tøft å være død’ (‘Being dead isn’t cool’) is a campaign targeted at pupils in lower secondary school, where the main element is a 90-minute school presentation that is supposed to give a realistic picture of the consequences of serious accidents. The presentation is made by a team that consists of a person who has been injured in traffic, a nurse in an emergency unit and others. In addition to the presentation, a module has been designed for preliminary and post work in groups with the focus on traffic safety. The objective of the campaign is to make adolescents more aware of the risks and consequences of risky behaviour in traffic and to develop good attitudes towards traffic safety. An evaluation of the campaign with before-and-after measurements of a test group and a control group showed that the adolescents had a positive assessment of the campaign; they identified with the person injured in traffic; and the presentation succeeded in arousing the adolescents’ emotions. The girls assessed the campaign much more positively than the boys. However, the evaluation showed that the campaign had no impact on attitudes or behaviour (Moan and Ulleberg, 2007).

### EDUCATION, TRAINING AND INFORMATION FOR ADOLESCENTS AGED 16–19

The 16–19-year-old adolescent age group may be the group for whom most has been done to promote safer behaviour in traffic through information campaigns and education and training programmes. Very many adolescents in this age group take ordinary driver’s education in order to get a driving licence for a moped, motorcycle and car. This ordinary driver’s education will not be discussed any further here; the Handbook of Road Safety Measures (Elvik et al. 2009; Høye et al., 2012) has a separate chapter about the effects of formal driver’s education.

Here we want to present and comment upon a number of other campaigns and programmes that have been conducted to inform and influence this age group.

#### Measures based on social norms

In the USA, the authorities have tried to influence adolescents to adopt safer behaviour in traffic on the basis of the so-called Social Norms Theory or social norms approach, which was briefly mentioned above. This entails that we all want to adapt our own behaviour to whatever is in keeping with

the prevailing social norm; i.e. that no one wants to be a deviant, and especially not adolescents. Thus, the logic in this approach is that when adolescents are informed that it is normal not to drive too fast, they will refrain from doing so themselves.

In the state of Montana in the USA, a campaign was conducted to reduce driving under the influence (DUI) among adolescents (Linkenbach & Perkins, 2005, in Ward 2010: 11). The background for this campaign was a study that showed very big disparities between the actual extent of DUI among adolescents and what the adolescents themselves believed that extent to be. The adolescents believed that the extent of DUI was much greater than it actually was.

The campaign had the objective of informing adolescents about how abnormal it actually was to drive under the influence. The message was: ‘Most Montana young adults [4 out of 5] don’t drink and drive’. A study showed that the campaign had brought about an increase in the number of correct perceptions of the extent of DUI, clear attitudes with regard to refusing to drive under the influence and less DUI. The campaign also resulted in a greater acceptance of the monitoring of and penalties for DUI (Ward et al., 2010).

A second example with the same theoretical basis was a seat belt campaign in the state of Arizona. The campaign was based on information about the safety effects of seatbelts and on information about the percentage of adolescents who actually use their seatbelt (NHTSA, 2008, in Ward et al., 2010: 10). As a result of this campaign, adolescents in the schools where the campaign was held drastically changed their opinions about the use of seatbelts, whereas the researchers found no change of opinion in the control schools that had not held the campaign. An ambitious Danish experiment tested and utilised these social mechanisms; i.e. by providing correct information about how rarely rule violations and risky behaviour actually take place, which corresponds somewhat to the Montana study and the Arizona seatbelt campaign mentioned above. However, the Danish study arrived at a number of surprising findings.

As expected, they found a strong correlation between the extent to which adolescents believe that their friends drive too fast and their own actual driving speed. The problem was that this correlation trended in the opposite direction from what

had been expected: adolescents who did not drive too fast underestimated their friends’ inclination to drive too fast, whereas those who drove too fast had a relatively precise guess. Hence, informing people about how many of them actually drive too fast will not bring any change in the desired direction; cf. the objection mentioned above to the information that was provided in ‘Oppdrag sykkelhjelme’ (Balvig, Gilman and Holmberg, 2011).

#### Significant others

A slightly different and more specific variant of utilising social norms is to try to let ‘significant others’ influence adolescents to behave more safely. One example of this kind of approach was the so-called ‘Sei ifrå’ (Speak up) campaign. Briefly stated, this involved encouraging young passengers in cars to ‘speak up’ and tell the driver if he/she drove too fast, was driving under the influence, was not using a seatbelt or had other behaviour that could result in an accident. These campaigns, which have mainly focused on speeding and DUI, have been used in a number of counties in Norway since 1993. The original idea probably came from Denmark, where two ‘guardian angel’ campaigns were conducted around 1990 (Studsholt, 1990).

Evaluations of the ‘Sei ifrå’ campaign show slightly different results. The number of accidents among young automobile drivers and passengers have been reduced in the counties where the campaigns were held, but it looks as if the campaign mainly has a favourable impact when it is conducted together with increased police controls, so it becomes an open question whether the impact is simply a result of the police controls and not of the campaign (Ulleberg et al. 2004; Ulleberg & Christensen, 2007).

A similar approach was chosen in ‘Jentenes trafikkaksjon’ (the girls’ traffic action), conducted by the Norwegian Council for Road Safety (NCRS). This campaign is targeted at girls, with the message that they should care and help ensure that persons their age (boys) who give them a ride shall behave responsibly in traffic. Jentenes trafikkaksjon made use of social media and established a special Internet community for girls where they could ‘meet’, exchange experiences, etc. In addition, they received regular reminders and safety-related materials on this site. However, an evaluation of Jentenes trafikkaksjon showed that the girls who took part in the action had not changed their attitudes and behaviour more than other girls in the same age group (Backer-Grøndahl, 2010).

**Information based on fear**

There are a number of campaigns that are based on arousing fears in order to promote changes in behaviour. This approach has been very widely used in campaigns to get people to stop smoking and to cease other risky activities. It has also been used to a great extent on adolescents in traffic. 'Ikke tøft å være død' ('Being dead isn't cool'), which was mentioned above and was conducted on lower secondary school pupils, is one such example from Norway. The 18/40 action is another. That was a campaign against speeding and accidents involving cars driving off the road that was conducted in two Norwegian counties at the close of the 1990s. According to Moe et al. (2010), evaluations of the campaign showed that adolescents had become more risk conscious, but that the campaign had not managed to influence those who were initially most at risk.

At the University of Galway, they have conducted meta-analyses of the impacts of fear-based campaigns (Carey, McDermott & Sarma, 2013). The conclusion was that they very often do not have the intended impact. New evaluations from Australia draw similar conclusions, and Australia is well-known from putting a great deal of effort into campaigns of this sort. Australian studies show that campaigns that depend on arousing fears of being perceived as a social deviant had a much stronger impact than traditional fear-based campaigns (Irwin, Reza & Chekaluk, 2012).

**THE FOLLOWING IS A LIST OF BULLET POINTS SUMMARISING THE MOST IMPORTANT FINDINGS:**

- Establish the traffic safety message as an individual responsibility, if that is possible. Try to avoid the problem of identifying safety as a 'collective responsibility'; i.e. that we perceive that it is others who must improve their attitudes and behaviour – not ourselves.
- Education and training and information must be found to be useful and relevant (where the seatbelt should be placed instead of that they should use the seatbelt, specific instructions about where the child should walk or cycle on the road to school instead of general traffic rules).
- Avoid statistical information that the recipient cannot make practical use of, e.g. information about the number of people who perish in traffic, etc.
- Avoid technical information such as:
  - The forces in a collision increase by a factor of 4, etc.
  - A crash at 40 km/h is equivalent to a fall of 10 metres, etc.
  - The braking distance increases by a factor of four when the speed doubles.
- Measures, education and training targeted at those who want to behave safely, but who do not manage to do so, can have a very positive outcome.
  - Has a proven effect with regard to the speed one chooses to drive according to Scottish studies
  - Can be used with regard to distractions in the car (mobile phone)
  - To resist peer-group pressure among adolescents (a bicycle helmet is uncool).
- Use combinations of measures to amplify the impact when this is possible.
- Education and training are most effective if they are systematic and well-thought-out, rather than just small 'stunts'.
- Education and training programmes are most effective if they are closely associated with actual traffic situations and are conducted in small groups.
- The pupils must be challenged to offer their own proposals and solutions – this fosters involvement and improves learning.
- Traffic education does not occur on its own, but is dependent on an adult supporting, instructing, explaining and broadening the perspective so that the specific learning can be transferred to new situations and the knowledge can be generalised.

- Information about how normal it is to use safety equipment or drive legally can have positive impacts.
- Information based on fear has little impact on behaviour. Studies show that it is possible to mobilise fear reactions, but that this manifests itself to little or no extent in changed behaviour.
- Small interventions and/or minor adjustments in behaviour can be easier to carry out: reflectors vs. bicycle helmet.

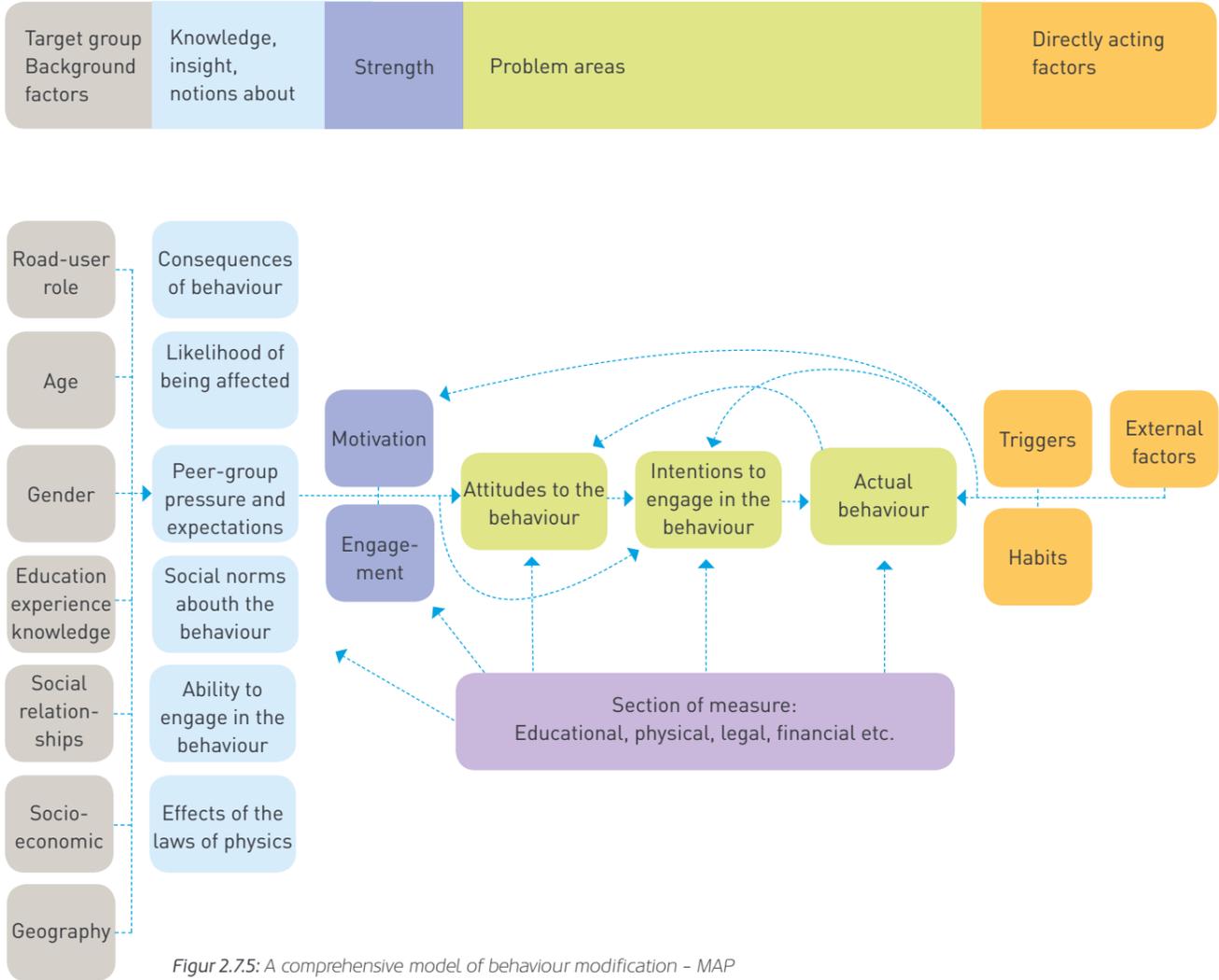


# Chapter 6

## RECOMMENDED USE OF THE MODEL

In this report, we have presented a model for the things that influence people's behaviour and the ways in which we can work to influence people to behave more safely in traffic. The social influence model has a scientific basis and reveals different dimensions in the work. In conclusion, we show

here how the model can be used in practice, and we give some examples of projects in the Norwegian Council for Road Safety. You have to read this together with the preceding chapters. Remember that flexibility and adaptation to your own project are important.



Figur 2.7.5: A comprehensive model of behaviour modification – MAP

**HOW TO USE THE NCRS'S SOCIAL INFLUENCE MODEL:**

1. Choose a problem area and analyse how the problem manifests itself. Say something about the target group's conditions and needs. Link the problem area to NCRS's strategic plan and put the measure in a broader perspective.
  - Green and grey boxes, see Chs. 1 and 2.
2. Analyse causes and psychological and/or social processes and define the kind of processes that should be in focus – knowledge, insight or notions?
  - Light blue boxes, see Ch. 2.
3. Specify a target group if the analysis makes that necessary. The target group can be adults who are responsible for children and adolescents; it can be children and adolescents; or it can be the authorities.
  - Grey boxes, see Ch. 2.
4. Identify motivation and commitment in the target group and show how this affects the selection of measures and methods.
  - Dark blue boxes, see Ch. 2.
5. Consider step 1 again and specify goals for the measures.
  - Green boxes, see Chs. 3 and 4.
6. Analyse whether 'directly acting factors' are relevant to the problem. Discuss how they can support or maybe counteract the effort.
  - Yellow boxes, see Chs. 2 and 3.
7. Assess the use of measures and combinations of measures, e.g. educational, physical, legal, financial. Efforts to modify behaviour work best through combinations of measures, but it is also important to set limits.
  - Purple box, see Chs. 2 and 3
8. Create an evaluation plan. On the basis of the issue, target group, analyses and ways and means, you should implement a process and/or impact evaluation. If possible, do both. Specify what shall be evaluated. Determine the design and method of the evaluation.
  - Light blue and green boxes, see Ch. 4.
9. A. When the measure is education and training, use the 5E model as a tool.  
 Show how you engage the pupils, let them explore, explain, elaborate and evaluate the measure.  
  
B. When the measure is a campaign or promotional effort  
 Show how you follow CAST and the principles described in Chs. 4 and 5.

**EXAMPLE OF USE OF THE MODEL BASED ON THE CHILDREN'S TRAFFIC CLUB**

1. **Choose a problem area and analyse how the problem manifests itself. Say something about the target group's conditions and needs. Link the problem area to NCRS's strategic plan and put the measure in a broader perspective. Green and grey boxes, see Chs. 1 and 2.**

The Children's Traffic Club must be considered in context with the needs of society and families for traffic safety while children are growing up. Children have a right to grow up safely and securely, and traffic safety should be an important and natural part of their everyday life. Traffic safety for children is the adult's responsibility and involves physical arrangements, the use of safety equipment, education and training, guidance and support. Children must gradually be given more and more responsibility for themselves and their safety. If we establish good habits when the children are still small, it is likely that they themselves will become responsible road-users. Now that the club has been in operation for 50 years, we see that the living conditions of families with small children have changed, and nowadays most children attend a day-care centre. The day-care centre has become a public arena where the parents of small children meet. Therefore, we want to make contact with day-care centres and use them as the main arena for a new club.

Children are road-users every day, as passengers, as pedestrians and as they grow older as cyclists. The most important learning is practical, through their own experiences. Adults are important role models. The choice of the form of transport to the day-care centre and to school, work and leisure-time activities affects the child's traffic education. The day-care centre must regard traffic safety as part of their HSE work, their cooperation with parents, and the implementation of activities scheduled throughout the year. Traffic is a part of our everyday life, which can give rise to both stress and dangerous situations, but which can also give us good times, freedom of motion and pleasure.

A major effort to combat traffic accidents involving children has given good results, and the accident picture is fortunately completely different than it was in the 1960s and 70s. The goal is to maintain this

positive trend, which we think can be best achieved by long-term, preventive measures. New generations require a continuous effort in this area. The traffic picture changes, and education and training are the best basis for ensuring 'responsible road-users', a premise in the vision of zero traffic fatalities. Many day-care centres and families with small children are concerned about traffic safety, but not all of them. We want to help ensure that traffic is included in a natural way in the implementation of activities scheduled throughout the year in day-care centres and that traffic is a topic in the cooperation with parents. Here we meet everyone and can thereby ensure a greater provision of training on an equal basis. Adults are role models, and their attitudes to traffic safety are fundamental to their children's development of an understanding of traffic. At present, almost all children attend a day-care centre from ages one to six, and that is why we are choosing the day-care centre as our main arena.

2. **Analyse causes and psychological and/or social processes and define the kind of processes that should be in focus – knowledge, insight or notions. Light blue boxes, see Ch. 2.**

We believe that most people have good intentions about safeguarding the best interests of children, but in busy everyday life, traffic safety can be forgotten in favour of other areas in which people have to engage. Many adults may find it unpleasant to be confronted with attitudes and careless behaviour with regard to obeying traffic rules. Hence, in this project we will primarily focus on peer-group pressure and norms. In addition, we will play an active role in presenting knowledge about the use of safety equipment, especially correct protection of children in cars and the use of reflectors.

Social norms – traffic safety ought to be a natural part of a child's education and hence of the content presented in day-care centres. It is important to establish good habits at an early age. Through insight and public awareness campaigns, we want to persuade staff and parents to take their responsibility as role models.

Peer-group pressure – staff and parents can exert a positive influence on each other through insight and notions so that time is set aside for conversations, so that they reach agreement about common rules outside the gates when groups of children are on outings during day-care centre hours, etc. This may help prevent negative peer-group pressure, keep the

situations from becoming chaotic and unsafe, and ensure that the adults do not have an insufficient understanding of the inherent risks.

Knowledge of the effects of the laws of physics is relevant with regard to knowledge about the use of safety equipment. This applies to both knowledge and acceptance of rules and recommendations.

**3. Specify a target group if the analysis makes that necessary. The target group can be adults who are responsible for children and adolescents; it can be children and adolescents; or it can be the authorities. Grey boxes, see Ch. 2.**

The main target group is day-care centre staff. They are the ones who draw up the annual plan.

Boards are responsible for the children's safety through the HSE regulations and because they have the main responsibility for the day-care centre's content and the daily operations. Boards may decide that the whole day-care centre will join the Children's Traffic Club. We consider this in close connection with NCRS's certification of traffic-safe municipalities and/or day-care centres.

The educational supervisor in a day-care centre is responsible for a department and that department's annual plan and cooperation with parents. The educational supervisor can enrol that department in the Children's Traffic Club and has the role that we focus most on when we create content. The educational supervisor is the supervisor of the other, often unskilled, staff. We consider this in close connection with our course activities.

Other staff are the ones who have the most contact with the children, who know the children well and who often go alone on outings with small groups of children.

Parents play the most important role in the children's development and upbringing, and this is also true with regard to traffic safety. They can be given information directly on the Internet and Facebook, and the educational supervisor receives material concerning parental cooperation, written reports, tips and advice, and knowledge about safeguarding children in cars, etc.

Children are obviously also a target group. The Children's Traffic Club was created in order to

ensure that children stay safe in traffic, in this case by the adult's taking responsibility. We think that such small children should not be allowed to move about alone in mixed traffic, but we have set ourselves a goal of teaching children some of the basics about what is safe and what is dangerous in traffic. This must be adapted to the challenges that children encounter in their everyday lives.

**4. Identify motivation and commitment in the target group and show how this affects the selection of measures and methods. Dark blue boxes, see Ch. 2.**

In the autumn of 2013, NCRS conducted a survey in day-care centres in order to acquire knowledge about the target group for the launching of a new club. The motivation and commitment are assessed to be relatively great, but we see a need to get more people and/or everyone involved. We are relatively satisfied that about 80 per cent of the day-care centres have written guidelines for outings on foot and if accidents occur. We are positively surprised that 57 per cent say that they have heard about the concept of a traffic-safe day-care centre. Most of these people have heard about this through NCRS's newsletter and through NCRS's web site. However, we are not satisfied that only half of Norway's day-care centres say that they have traffic in their plans. The following findings may be of interest in the ongoing work:

- 43 % of the day-care centres had incorporated the topic of traffic in their individual departments or their plan for the period.
- 56 % have written guidelines for the use of public transportation.
- 49 % have guidelines for the purchase of transport services.
- 49 % use NCRS's glove puppet, Tarkus, in the day-care centre.

**5. Consider step 1 again and specify goals for the measures. Green boxes, see Chs. 3 and 4.**

The comprehensive goal for the measure is that as many day-care centres as possible shall have traffic as a topic in their annual plans, both on paper and in practice.

Based on the survey in day-care centres and on experience, we have set the following goals for attendance in the club:

- **2016:** 20 % of the nation's day-care centres join the club (to be launched in the summer of 2016)

- **2017:** 30 % of the nation's day-care centres join the club
- **2018:** 40 % of the nation's day-care centres join the club

There are a little more than 6,000 public and private day-care centres in Norway.

Day-care centres that are members must be able to show that they have traffic in their annual plan, have written guidelines for outings on foot, the use of public transportation and the purchase of transport services. They must show that the topic of traffic is part of the parental cooperation, which entails that it is also part of the work of the staff.

We shall influence the insight, attitudes and knowledge of day-care centre staff, cf. social norms (whether traffic safety has become a natural part of the education and the day-care centre's content, whether the adults are conscious role models), peer-group pressure (whether staff and parents exert a positive influence on each other, whether there is time for them to have conversations, whether they agree on common rules outside the day-care centre's gates, etc.) and knowledge about the effects of the laws of physics (children in cars, reflectors).

**6. Analyse whether 'directly acting factors' are relevant to the problem. Discuss how they can support or maybe counteract the effort. Yellow boxes, see Chs. 2 and 3.**

So far, the national curriculum for day-care centres has made no mention whatsoever of traffic safety. Starting in the autumn of 2017, there will be a new national curriculum, and in the consultation memorandum it is stated that through work with the local community and the society, the day-care centre shall help ensure that the children 'explore different landscapes and become familiar with institutions and places in the local community and learn to safely orient themselves and get around.' Coping skills and public health are part of the value base in the day-care centre. We think that this will be a factor that can support the work with the Children's Traffic Club, and it will make it easier for NCRS to involve the Norwegian Directorate for Education and Training in new measures in the day-care centre and also in the National Plan of Action for Road Traffic Safety. The Norwegian National Centre for Food, Health and Physical Activity may be a good ally in order to strengthen our message.

The attention to pedestrians and cyclists, the Children's Transport Plan, the goal that 80 % of all children shall cycle or walk to school – all of these things may help boost membership in the Club.

NCRS holds day-care centre courses throughout the whole country. The course activities are related to the certification of traffic-safe day-care centres and to the Children's Traffic Club and will therefore help ensure that more directly acting factors can support the effort.

**7. Assess the use of measures and combinations of measures, e.g. educational, physical, legal, financial. Efforts to modify behaviour work best through combinations of measures, but it is also important to set limits. Purple box, see Chs. 2 and 3.**

The educational measure may be combined with physical measures such as the Hjertesoneprosjekt (the Protected-zone project) in the schools, where they try to allow as little car traffic as possible in the vicinity of day-care centres and schools. Legal provisions concerning the use of safety equipment in cars and busses will be put into practice in the project. Financial support schemes such as free day-care centre courses, the distribution of materials, recruiting campaigns with prizes, etc. are well-suited to this project.

**8. Create an evaluation plan. On the basis of the issue, target group, analyses and ways and means, you should implement a process and/or impact evaluation. If possible, do both. Specify what shall be evaluated. Determine the design and method of the evaluation. Light blue and green boxes, see Ch. 4.**

**Process evaluation**

- We want to see how day-care centre staff evaluate
- information material about the Club
  - the user-friendliness of the web site
  - the value of material that is created for the Club – posters, reflector products, board games, glove puppets, books, etc.
  - course evaluations

By regularly paying attention to this, we can adjust the project under way and find out more about the users' motives and interests.

**Impact evaluation**

We choose two types of impact evaluation.

- **Membership.** We update the membership lists monthly and make the lists available to our district administrators, who are responsible for achieving the targeted figures for each county, cf. the targeted figures in point 5. Membership data per year are documented in annual reports. This will begin in 2016 and will be performed annually.
- **Study of insight, attitudes and knowledge,** cf. social norms (whether traffic safety has become a natural part of the education and the day-care centre's content, whether the adults are conscious role models), peer-group pressure (whether staff and parents exert a positive influence on each other, whether there is time for them to have conversations, whether they agree on common rules outside the day-care centre's gates, etc.) and knowledge about the effects of the laws of physics (children in cars, reflectors). Planned for 2019..

## EXAMPLE OF THE USE OF THE MODEL BASED ON INFLUENCING THE USE OF PEDESTRIAN REFLECTORS

- 1. Choose a problem area and analyse how the problem manifests itself. Say something about the target group's conditions and needs. Link the problem area to NCRS's strategic plan and put the measure in a broader perspective. Green and grey boxes, see Chs. 1 and 2.**

Counts performed by the Norwegian Council for Road Safety (NCRS) show that about 40% of all Norwegian adults use reflectors when they walk in the dark. The percentage is higher outside urban areas (47%) than in urban areas (31%). In the National Plan of Action for Road Traffic Safety 2014-2017, indicator targets have been set for the use of pedestrian reflectors. The target for 2018 is 60% use outside of urban areas and 40% use in urban areas. This means that there is a need for an effort that can help to significantly increase the percentage of use over a relatively short period of time.

35 % of all pedestrian accidents occur in the dark. The use of reflectors reduces the risk of being killed in pedestrian accidents in the dark by 50%, whereas the risk of being seriously injured is reduced by 38 %.

The visibility of pedestrians is important both when

they are walking along the road and when they are crossing the road. Visibility depends on where the drivers can be expected to catch sight of pedestrians. Illumination, the lights on the vehicles and the pedestrians' clothing also have a significant effect on visibility. The problems with poor visibility are intensified when the road is wet and when there is light from oncoming cars (spill light). In addition, we may assume that many drivers have reduced visual ability in the dark. They do not always reduce their driving speed in the dark to compensate for the reduction in visibility. The Norwegian Road Traffic Act's requirement that the driver must be able to stop on the stretch that he/she can see, is not always complied with in practice. This means that the visibility distance in the dark for high beams and low beams respectively appears to have little significance to the drivers. It is uncertain whether or not the drivers expect that all pedestrians will use reflectors. This may affect their driving speed and their level of attentiveness (looking for pedestrians along the road).

The government's target that the growth in traffic in the cities shall include pedestrians, cyclists and public transportation may help increase the exposure of pedestrians. Increased use of public transportation will also increase the percentage of pedestrians. This may result in more pedestrian accidents because of their increased exposure. Increased use of reflectors is important in order to avoid more pedestrian accidents.

Children use reflectors more frequently than adults. The percentage of use appears to decrease in the adolescent years, and the main problem is the large group of adult pedestrians who do not use a reflector in the dark.

- 2. Analyse causes and psychological and/or social processes and define the kind of processes that should be in focus – knowledge, insight or notions? Light blue boxes, see Ch. 2.**

We do not know why a relatively large group of pedestrians does not use reflectors. We can also assume that the use of reflectors varies individually over a period of time. This means that some people use reflectors all the time and some now and then or never. The choice to use them is not necessarily always a conscious one. The availability of reflectors probably also has a significant effect. If the reflector is available when you need it, the probability that you will use it increases. This makes it difficult

to define a group of users or non-users.

Among adolescents, psycho-social factors such as peer-group pressure may have a significant effect. When the use of a reflector puts you in the 'out-crowd', it takes strength to resist the pressure. When the use of safety equipment in general conflicts with the group norm, this will also have a significant effect on the use of reflectors. 'Cool' reflectors from a brand-name producer may also be perceived as stigmatizing by those who would prefer not to use that producer's main products (clothing, shoes, backpacks, handbags, etc.).

We assume that the adult population for the most part is well aware of the importance of using a reflector. Many pedestrians also drive a car, so they can be expected to have some knowledge and insight in this area. The notion that 'when I see the car, the driver sees me,' is probably fairly common, especially on open stretches and in areas with streetlights. In addition, it is easy to imagine that many pedestrians have a notion that they themselves can avoid dangerous situations by waiting to cross the road or by stepping back off the shoulder of the road when they are not noticed by a driver.

- 3. Specify a target group if the analysis makes that necessary. The target group can be adults who are responsible for children and adolescents; it can be children and adolescents; or it can be the authorities. Grey boxes, see Ch. 2.**

In this example, the target group was selected on the basis of the risk situation. Most adult pedestrians do not use a reflector in the dark. The use of reflectors must primarily be influenced at the individual level, even though it is conceivable that this will occur through measures other than information campaigns and education and training programmes. Ordering the mandatory use of reflectors is one such example.

Another approach would be to limit or divide up the group of adult pedestrians (all employees of Statoil, all municipal employees, everyone who walks in the dark wearing dark clothing, etc.). Regardless of the approach, this is a safety problem that affects a non-homogeneous group. The only things they have in common are that they are adults and that they do not use a reflector at times or all of the time. In other words, we do not really know who they are or where we can contact them.

- 4. Identify motivation and commitment in the target group and show how this affects the selection of measures and methods. Dark blue boxes, see Ch. 2.**

The use of a reflector is a simple and effective measure for reducing pedestrian accidents in the dark. Despite the relatively high risk of walking in the dark, most people have no experience to indicate that this is dangerous. Most people have never been hit by a car. Drivers experience the problem in a different way. Most of them have been in situations where they did not perceive a pedestrian early enough so that they were surprised or frightened. In spite of this, it is uncertain whether this motivation is sufficient to ensure that they themselves use a reflector when they walk in the dark.

The use of a reflector can also be situation-dependent. It appears as if a higher percentage of people use reflectors when they are out training in the dark. When people are training, it also seems as if most of them are more concerned about their visibility than otherwise. It is not unusual for people out training to combine the use of a reflective vest with regular reflectors and reflectors on their exercise clothes and shoes.

However, there is little to indicate a genuine aversion to the use of reflectors. It can be assumed that most adults regard their use as beneficial and unproblematic. The biggest problem is probably that they 'forget' to use reflectors.

There has been a focus on the design of reflectors in many measures in recent years. We have no knowledge about how this affects their use. It is conceivable that special reflectors will help increase the awareness of the use of reflectors in the dark. Some people also say that certain types of reflectors are fine, 'cool', help create an identity, and are practical to use. It is uncertain whether the reflector's image is crucial to whether or not someone will use a reflector. The question is whether that use or non-use is based on a rational decision and to what extent emotions are involved.

- 5. Consider step 1 again and specify goals for the measures. Green boxes, see Chs. 3 and 4.**

The target for this measure may be described as a specified increase in the percentage of use. It is natural to compare the data with the indicator targets in the National Plan of Action, which were

set at 60% use in rural areas and 40% use in urban areas in 2018. For 2017, we would like to see an improvement over the situation in 2016. One example could be:

In our counts in 2017, 35 % of the adult pedestrians shall use a reflector in the dark when they go out in urban areas. The corresponding figure for country roads (outside of urban areas) could be 55 %.

The target must be realistic in the sense that it must be equivalent to the expected impact of the measures. If we do not do anything that we know will work, or do not do more of what we know works, we cannot expect any increased use of reflectors. This is also related to the available financial and human resources of those who implement the measure.

In addition, the target must be clear and it must be possible to test the results. It is not sufficient to say that the use of reflectors shall increase. In that case, we would have very little to base the results on when we evaluate the measure. The use of reflectors is quantifiable and must therefore be measured quantitatively.

Even if we do nothing, the use of reflectors may increase or decrease because of chance occurrences or because completely different factors influencing behaviour occur while we are implementing the measure. Examples of this kind could be a dramatic increase in pedestrians hit by cars, market mechanisms that make reflectors fashionable or the passing of new regulations making it mandatory to use reflectors.

**6. Analyse whether 'directly acting factors' are relevant to the problem. Discuss how they can support or maybe counteract the effort. Yellow boxes, see Chs. 2 and 3.**

If it becomes mandatory to use reflectors, that may support our efforts by calling greater attention to the problem. This will probably stimulate a debate and raise questions, such as how the police should enforce this order, whether it should be enforced, how large the fine should be and how dark it has to be. Experiences from Finland show a clear increase in the use of reflectors after the introduction of this kind of order, but a gradual decrease in reflector use thereafter.

Longer periods with dark, wet asphalt as a result of short-term climate fluctuations can increase the

perceived risk among pedestrians and hence also the use of reflectors. New products and increasing integration of reflectors in outer garments can result in increased use of reflectors.

NCRS's fuss about the use of reflectors may be perceived as paternalism. This can increase resistance to the use of reflectors in order for some people to emphasise that they will not accept being dictated to when it comes to the use of safety equipment.

**7. Assess the use of measures and combinations of measures, e.g. educational, physical, legal, financial. Efforts to modify behaviour work best through combinations of measures, but it is also important to set limits. Purple box, see Chs. 2 and 3**

Actions to promote reflectors, such as 'Reflector Day', are used as a method for attracting attention to the use of reflectors in the dark months of the year. This attracts attention in the media, which functions as a reminder to pedestrians. Designer reflectors can result in increased use of reflectors, but are not supplied in numbers that meet the need in the population, nor do we know whether this is necessary in order to get people to use reflectors. At local events, most people will gladly accept a reflector, but we do not know how this affects the use of reflectors in the long run.

The low percentage of reflector use in urban areas is probably due to the pedestrians' belief that the streetlights give them sufficient visibility. In many places, street lighting is highly inadequate. There are many local examples where pedestrian crossings in urban areas are located far from a streetlight and where the lighting may also be old and inadequate. Some of these crossings are located in 60 km/h zones even though the Norwegian Public Roads Administration's manuals recommend a lower speed limit at crossings in combination with physical measures to reduce speed such as speed bumps. A focus on local problematic points and stretches of this kind may highlight the risks and problems that arise when the driver does not see the pedestrian. Through requirements to the road owner and pressure in the media, this can be used to simultaneously motivate pedestrians to protect themselves against being hit by a car. It is possible to increase understanding through the use of examples with which people can identify. In that way, the use of reflectors becomes relevant for the recipient of the message. This angle can be easier

to understand than the insight and knowledge based on risk data, safety distances, visibility distances, reaction distances and braking distances.

The risks of being killed or badly injured are theoretical quantities that are not perceived as relevant to the individual. Describing the problem in terms of local, neighbourhood and known situations can be one way of making it more the driver's problem and hence more the pedestrian's problem as well.

Using reflectors is an active and often a deliberate choice. This choice requires that the reflector be available. This availability must be immediate and near. A smart way to distribute reflectors can help encourage many people to also use those reflectors. Some people find it natural to go to a place that sells reflectors. Others ask about reflectors in places where they are given away for free. Some never ask for a reflector and are thereby dependent on more or less 'stumbling' over the reflector when they are out after dark.

A mandatory order to use a reflector is a demanding effort that will encounter a certain amount of resistance. Nevertheless, it is likely that this measure in combination with an information campaign will have a positive impact. A mandatory order may affect behaviour and thereby the social norm that reflectors should be used. The use of reflectors does not encroach on the individual's freedom; it merely requires that you do a little more than you did before. (Cf. the introduction of the Act relating to Prevention of the Harmful Effects of Tobacco in Norway).

**8. Create an evaluation plan. On the basis of the issue, target group, analyses and ways and means, you should implement a process and/or impact evaluation. If possible, do both. Specify what shall be evaluated. Determine the design and method of the evaluation. Light blue and green boxes, see Ch. 4.**

Formative evaluation

- Process evaluation
- Assess deliveries relative to what it has been decided shall be implemented (Tasks)
- Be exact in assessing whether all foreseen measurements have been implemented in the correct amount or scope.
- Assess the organisation of the measure with a view to the effectiveness it has given at various levels (parts) of the organisation.
- Assess whether the impact results are accepta-

ble and determine whether the measure shall be continued, altered and/or adjusted or terminated. (See the impact evaluation below).

Example:

To enable us to measure impacts on a national basis, an agreed measure ought to be implemented in the same way over the same period of time and with the same pressure in all counties.

Impact evaluation

- Let zero be the point of departure. This preliminary situation makes it possible to compare the impact of the measure over a period of time. The percentage of reflector use in year x is compared with the percentage of use in year y, etc.
- The counts must be conducted in the same way as in the zero point-of-departure year. A change in the method of counting will affect the results and create biases over which we have no control.
- The variation between urban areas and country roads in rural areas must be reconciled so that they do not create biases, on the basis of the number of kilometres in urban areas and of country roads in the various counties.
- The counts must be large enough that they give statistical significance at an acceptable level. If possible, a regression analysis should be conducted in order to correct for unknown factors influencing behaviour.

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