

**DRIVER COMPETENCE IN A HIERARCHICAL PERSPECTIVE;  
IMPLICATIONS FOR DRIVER EDUCATION**

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# TABLE OF CONTENTS

INTRODUCTION.....	2
<b>A HIERARCHICAL PERSPECTIVE ON DRIVING .....</b>	<b>2</b>
<b>Cognitive psychology.....</b>	<b>4</b>
<b>Description of the hierarchical levels .....</b>	<b>5</b>
Level 4: Goals for life and skills for living .....	6
Level 3: Goals and context of driving .....	7
Level 2: Mastery of traffic situations .....	8
Level 1: Vehicle manoeuvring .....	8
<b>The hierarchy is more than its parts .....</b>	<b>9</b>
<b>CONTENTS AND GOALS OF DRIVER EDUCATION: A FRAMEWORK .....</b>	<b>11</b>
<b>Central content of driver education: Describing the columns .....</b>	<b>12</b>
Knowledge and skills .....	12
Risk increasing factors .....	13
Self-evaluation .....	14
<b>Teacher-knowledge or learner-knowledge?.....</b>	<b>15</b>
<b>A constructivistic view on learning.....</b>	<b>16</b>
Consequences of the constructivistic view to driver training .....	17
<b>Content of curriculum, course or exercise.....</b>	<b>22</b>
<b>Summary.....</b>	<b>25</b>
<b>THE GDE-FRAMEWORK AND DRIVER EDUCATION.....</b>	<b>26</b>
<b>Level 1: Vehicle manoeuvring.....</b>	<b>28</b>
Knowledge and skills .....	29
Risk increasing factors .....	30
Self-evaluation .....	31
<b>Level 2: Mastery of traffic situations.....</b>	<b>32</b>
Knowledge and skills .....	33
Risk increasing factors .....	34
Self-evaluation .....	35
<b>Level 3: Goals and context of driving.....</b>	<b>36</b>
Knowledge and skills .....	37
Risk increasing factors .....	38
Self-evaluation .....	40
<b>Level 4: Goals for life and skills for living.....</b>	<b>42</b>
Knowledge and skills .....	43
Risk increasing factors .....	43
Self-evaluation .....	44
<b>CONCLUSIONS.....</b>	<b>45</b>
<b>References .....</b>	<b>47</b>

## **INTRODUCTION**

This work is an effort to give a thorough description of the "GDE-framework" (Goals for Driver Education), which has its origin in Finnish research within the field of traffic psychology. The framework was introduced in its present extended form within the EU-funded research project GADGET (Hatakka, Keskinen, Gregersen & Glad in Gadget, 1999) and published internationally for the first time by Hatakka, Keskinen, Gregersen, Glad & Hernetkoski (2002). Stemming from the project, the framework is sometimes referred to as the "Gadget-matrix".

The GDE-framework has been widely acknowledged within the European traffic research community as a fruitful theoretical starting point when developing traffic education. However, being a model of quite complicated phenomena, the framework has been criticised for lack of detail. The objective of this work is therefore to try to clarify and illustrate the framework to facilitate its implementation. The intention is not to provide hard and fast rules for what one should do on traffic school level. Some practical examples are given as general guidelines and to highlight the points raised, with no intention to try to cover every possible situation that might occur in driver education, or every pedagogical method. The authors hope that these guidelines will be of help when designing driving school curricula.

This work is divided into four chapters, beginning with a summary of theories and a description of a hierarchical approach to driver behaviour, training and education. A short introduction to cognitive psychology is also included. The second chapter provides an overview of the GDE-framework, as well as a short introduction to the constructivistic view of learning. These two chapters are to large extents based on the GADGET-report and Hatakka et al. (2002). The GDE-framework is then dissected in the third chapter. This chapter forms the bulk of this work as each structural element of the framework is examined from the viewpoint of its content and its implications for driver education. The fourth chapter sums up the main points.

Text material published by the authors in scientific journals have been utilised whenever possible in order to avoid "inventing the wheel again" so to speak, although the material has been adapted to the needs of the present work. Apart from the two sources mentioned above, also Keskinen et al. (1998) deserves to be mentioned. No further reference is made to these in the text. Also the work put into the EU-funded research projects DAN (2000) and ADVANCED (2002) has been utilised. Although these are independent projects, a common feature is reliance on the GDE-framework.

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## **A HIERARCHICAL PERSPECTIVE ON DRIVING**

Driving is a complex task, but describing driving and the skills that are needed when driving is even more complex. Although knowledge of how to use the controls of a

car and how to manoeuvre it forms the basis of driving, an analysis of the driver's task and accidents has shown that adequate psychomotor skills and physiological functions are not sufficient for good and safe driving. This conclusion concurs with the notion that driving is by and large a self-paced task (Näätänen & Summala, 1974). It is ultimately up to the driver's own actions and decisions how successful and safe his or her driving is.

Modern research in traffic psychology shows not only the importance of performance factors, i.e. **what the driver can do**, but also the importance of motivational and attitudinal factors, i.e. **what the driver is willing to do** (e.g. Rothengatter, 1997). This observation concurs with the distinction between the concepts “errors” and “violations” in driver behaviour (Reason, Manstead, Stradling, Baxter & Campbell, 1990; Parker, Reason, Manstead, & Stradling, 1995). Errors are regarded as behaviour (actions, manoeuvres etc.) with a non-intended outcome. Violations, on the other hand, refer to faulty actions (especially from a safety point of view) made deliberately despite having knowledge of their possible implications. This distinction is fruitful e.g. when discussing age and gender differences in traffic (e.g. Rimmö, 1999).

Ever since Miller, Galanter, & Pribram (1960), hierarchical approaches have been used when trying to conceptualise and explain human behaviour. The importance of hierarchical approaches is realised also in the general debate in traffic psychology (Janssen, 1979; Michon, 1985 and 1989; Ranney, 1994; Summala, 1985). Earlier hierarchical approaches focused on the performance aspects of driving behaviour (Mikkonen & Keskinen, 1980; Rasmussen, 1980; van der Molen & Bötticher, 1988), but such an approach can also be used to combine the motivational and attitudinal aspects of driving behaviour with performance, or operations in certain traffic situations. Such a combination (Fig. 1) was developed by Keskinen (1996), building on the earlier three-level hierarchy by Mikkonen & Keskinen (1980).



Fig.1. Hierarchical levels of driver behaviour (adapted from Keskinen, 1996).

The hierarchical view of driver tasks, as presented in Figure 1, owes to cognitive psychology, which is currently the dominant approach in psychology. A comparative overview of various hierarchical theories may be found in Keskinen et al. (2000).

## Cognitive psychology

The cognitive approach to psychology, and thus also the hierarchical approach as defined here, looks upon individuals as active and goal-directed participants in and observers of their environment, e.g. traffic. The internal mental processes of an individual are emphasised as being the driving force behind all behaviour, and the observable behaviour is then just the end result of a long process.

Furthermore, according to the cognitive approach, the reality we see and experience is not stored in our mind as an exact copy. On the contrary, what is stored is a personal reconstruction, an abstract mental representation or inner model<sup>1</sup> of reality (e.g. Neisser, 1976; Rauste - von Wright & von Wright, 1994). There are two main dimensions in this process: Firstly, the already existing mental representations guide our search for information (e.g. what we see or what we read). Secondly, they serve as structures for interpreting this information. As a general rule, we tend to interpret reality so that it complies with our previous knowledge and expectations (Neisser, 1976) and we wish to dismiss conflicting information. In other words, the mental representations help us to guide and focus attention and perception, and facilitate interpretation and understanding of those perceptions. They also guide decision-making and action.

The mental representations are not permanent or unchangeable. They are constantly checked against new experiences, perceptions and interpretations of the outer world in an ongoing process, and modified accordingly if necessary. The process might be described as **continuous interaction between the desired goal, the actions aiming towards that goal, and the feedback<sup>2</sup> from these actions**. These new experiences can change the existing mental representations so that they correspond better to the new reality. They may on the other hand strengthen the old inner models. In other words, these processes influence what is taken in and how things are understood for example in a learning situation. This can be for good or bad. An example of positive change (from a safety point of view) might be when a young driver realises that it is far better to avoid dangerous situations instead of trying to use the acquired skills to the limit and try to master the situations as and when they occur. An example of negative strengthening might be skid training that fails to convey a message of danger and instead strengthens a self-belief that great skill in manoeuvring is the key to survival (cf. Glad, 1988).

This interaction process is both serial and parallel, and it is difficult to define one dimension without the other two. Goals and actions aimed at achieving these goals would not be useful if there were no feedback. And, if there would not be any goals, feedback and awareness of one's actions and behaviour would be useless (Ridley et

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<sup>1</sup> Other concepts denoting more or less the same idea are e.g. mental plans, and schemas.

<sup>2</sup> Feedback in this sense is a pre-requisite for learning, i.e. any information about the correctness or appropriateness of an action.

al., 1992). This process of goals, actions and feedback is relevant in all behaviour. When doing something we compare our actions with the desired goal. That comparison gives us feedback (which, of course, can come also from outside ourselves, e.g. from other people) which can modify our actions accordingly. The idea of making continuous comparisons between the present situation and the desired goal, and adjusting and modifying one's behaviour accordingly was presented already in 1960 by Miller, Galanter & Pribram in their TOTE-model<sup>3</sup>.

## Description of the hierarchical levels

The four hierarchical levels (Fig. 1) should be looked upon in light of what was said above about the interaction between a desired goal, the actions aiming towards that goal, and the feedback from these actions.

Although the levels are qualitatively different from each other and separated in the model, no single level is independent from the other levels. They are all present in a driving situation, and together they encompass the different components that are present in a driving task.

A basic assumption in the model is that a higher level controls and guides behaviour on a lower level. However, this control is not a simple top-down process as it is constantly checked against the feedback received from the action itself. The levels are to some degree interdependent so that change at one level by necessity brings about change at other levels too, downwards as well as upwards. But interdependence does not imply equality. The cognitive structures that we call the "highest level" (level 4 in the model) provide the basis for a person's way of life, in general as well as in the specific traffic context. They are therefore more stable and fundamental compared to the other three levels, which in turn are more domain-specific and subordinate. Abilities (skills) that are used, and the inner models that are applied (choices that are made) at the lower levels are therefore under guidance of higher level preconditions (including higher-level skills for coping in life) and demands (including goals and motives). This is the essence of the distinction made in the beginning of this chapter between **what the driver can do**, and **what the driver is willing to do**. The factors and inner models that are located on the highest level are therefore the ones that are most important from a safety point of view. No matter what amount of safety-related knowledge a driver may have, the effect of this knowledge is ultimately dependent upon if and how the driver uses it.

Automatism of behaviour and action is another issue that deserves to be mentioned here. As human processing of information is limited, the control of certain functions such as gear changing (a function on level 1) or scanning of the environment when driving (a function on level 2) becomes automatic through experience. For an experienced driver, such operations are more or less subconscious, freeing mental capacity. This issue is dealt with later.

The levels are presented below in reverse order from the more abstract fourth level to the basic first level. Although this contrasts with the principal order in which things

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<sup>3</sup> Test - Operate - Test - Exit: A basic model of planned behaviour in which actions are based on plans of execution, which in turn are modified through feedback from the results of the executed action.

ought to be treated in driver education, it is the order of importance of the cognitive contents in the levels for actual driving. It also follows from two presuppositions:

- A higher level controls and guides behaviour on a lower level.
- The fourth and highest level has overriding authority over the other levels.

Behaviour on each level is guided through internal models. These, in turn, are the result of learning in all its forms, from formal education to experiences gained in "the school of life".

#### **Level 4: Goals for life and skills for living**

The personal motives, behavioural style and abilities, and the social relations of a driver in a broader sense are the main ingredients in the highest level in the hierarchy. These include personality factors such as self-control, but also life-style, social background, attitudes, gender, age, group affiliation, importance of cars and driving as parts of one's self-image, and other **preconditions** that research has shown to have influence on choices and behaviour as a driver. There is ample proof that such factors also have direct influence on accident involvement (Berg, 1994; Gregersen & Berg, 1994; Hatakka, 1998; Jessor, 1987; Schulze, 1990). It goes without saying, perhaps, that these factors are closely connected to the society and the culture in which the driver lives. Important sources for the formation of internal models on this level are therefore family, friends, and other role models such as racing car drivers.

As was already pointed out, this level has overriding authority over the other levels in the hierarchy. The cognitive structures and preconditions on this level set the stage for the choices that are made and the inner models that are applied by a driver during a trip. For example, a person's general attitude towards alcohol and driving, and his or her personal use of alcohol in general are phenomena that belong to this level.

This level also includes factors such as a driver's physical and mental abilities (e.g. handicap and cognitive level of functioning). It is easy to understand the importance of these factors in a scene-setting sense. They are factors that the individual driver, or driver education for that matter, can do very little about other than taking them into consideration as something which limits the choices available. However, awareness of such personal limitations serves to lessen their negative effect.

Research in the field of traffic psychology has indicated that general motives as well as the developmental stage of the person are influential factors in determining traffic behaviour. Youngsters, for example, are frequently involved in risky behaviour (Evans, 1991). This is not necessarily for risk in itself, but because such behaviour serves certain developmental needs. Risky behaviour can thus be considered functional (Jessor, 1987).

Gregersen (1996b) has emphasised the importance of lifestyle factors and values that also affect driver behaviour. Likewise, Schulze (1990) and Gregersen & Berg (1994) show that lifestyle is intimately connected with driving behaviour: A highly car-oriented lifestyle seems to be particularly problematic. It can be hypothesised that, for example, when motives for self-enhancement are realised in the traffic context, a possibility for increased risk is created. It is reasonable to suggest that matters of this

kind should be included in driver training in order to make youngsters more aware of their personal processes and the possible motivational pressures they encounter while driving.

The differences between males and females in traffic risk can be traced back to lifestyle differences and the motivational aspects of driving. These differences are both qualitative and quantitative (Brühning & Kühnen, 1993; Farrow, 1987; Keskinen et al., 1992; Laapotti & Keskinen, 1998; Twisk, 1994b). Most investigations of young drivers have, however, either focused on males or have failed to distinguish between the behaviour of males and females (Jonah, 1990; Laapotti & Keskinen, 1998; Renge, 1983). This is why our image of a typical young driver's accident usually resembles the features of a male driver's accident rather than that of a female driver. Such a stereotypical young driver's accident would be a severe loss-of-control accident that occurs when the driver is driving at high speed during a weekend night while on a leisure trip with drinking friends.

Young female drivers' accidents have quite different characteristics. The mechanisms behind their accidents also seem to be different. They are indeed so different that it may not be possible at all to speak about typical young drivers' accidents. For example speeding and driving while impaired are typical for male drivers but rare for female drivers. Such differences are probably the result of differences in motives (Laapotti & Keskinen, 1998). Nothing indicates that female drivers possess better technical skills for dealing with various traffic situations or for vehicle manoeuvring than male drivers. Naturally, in addition to the effect of age, experience also has an independent effect on accident involvement (Maycock, Lockwood, & Lester, 1991).

All in all, the causes of accidents seem to vary considerably, and since training has to be adapted to the causes, a diverse selection of training methods has to be employed.

### **Level 3: Goals and context of driving**

The third level is a **decision** level, which in certain respects refers to the navigational and planning tasks of the driver that are described in earlier hierarchical conceptualisations of a driver's tasks (Janssen, 1979; Michon, 1985; Mikkonen & Keskinen, 1980; van der Molen & Bötticher, 1988). The content is broadened, however, to include trip-related goals and driving contexts, i.e. why a driver is driving on a certain occasion, where and when, and with whom. Included is e.g. planning of driving route and driving time (e.g. day-time or night-time driving) as well as choice of driving state (e.g. sober or impaired, relaxed or stressed, refreshed or tired) and driving company. The idea is that trip goals and considerations regarding the contexts of driving are affected by preconditions on the fourth level. The car becomes a tool as it were with which to fulfil articulated as well as non-articulated motives.

Different types and contexts of driving produce a different set of risks and put different demands on the driver. A choice regarding the when to drive as well as context-related matters may be the result of conscious considerations, or it may equally well be habitual or subconscious. For example, if the fourth-level precondition is a tendency of the driver to show off to peers, a choice on the third level may be to drive with a high speed despite slippery or otherwise bad road conditions. Although the physical environment in which the driver operates is as such beyond the



influence of the driver, he or she can normally choose whether to drive or not. For example, bad driving conditions may be encountered successfully if being cautious and making good decision e.g. regarding speed. As an example of a bad decision, and using the alcohol example above, a driver who does not consider the use of alcohol to be incompatible with driving may well choose to drive home after a wet evening with friends in the pub. Similarly, while middle-aged drivers typically drive to or from work or transporting family members, youngsters are more often engaged in driving for leisure purposes and in the company of friends (Laapotti & Keskinen, 1998).

The social context of driving is an especially important factor when young persons are concerned. Social pressure has a considerable impact on driver behaviour, as a driver is never alone on the road but in constant interaction with other persons, groups, social institutions and with society as a whole. In his description of social psychology, Allport (1985) describes how the "thoughts, feelings or behaviour of individuals are influenced by the actual, imagined or implied presence of others". This refers to an emotional experience of having to respond to someone's wishes or to some external body of authority regardless of this person is physically present or not. Passenger-related risks are emphasised in many traffic-related social psychological studies (e.g. Laapotti, 1994; Marthiens & Schulze, 1989). A social context in the form of a peer group represents the most important influence on the behaviour of young male drivers (Lewis, 1985). Farrow's (1987) and Laapotti's (1994) results support this statement. Young male drivers had more passengers than female drivers did in accidents where the cause was loss of control, and these passengers were more likely to be their friends. So called "disco-accidents" are also typical examples of accidents following peer-group pressure (Schulze, 1990). As Twisk (1994a) puts it, young drivers especially are not isolated individuals, but part of a closely-knit social structure.

## **Level 2: Mastery of traffic situations**

Focus on the second level in the theory is on competence that has to do with knowledge of how to drive in a certain traffic situation. A driver must be able to anticipate and adjust his/her driving in accordance with the constant changes in traffic (e.g. choose an appropriate speed). Knowledge of traffic rules, hazard perception, and interaction with other road users are typical contents on this level.

Choices that are made on this second level follow from third level choices and fourth level preconditions. For example, our friend driving home from the pub might be in for serious trouble in the dark on a winding road.

## **Level 1: Vehicle manoeuvring**

Any motivation to show off through driving (fourth level), or knowledge of traffic rules (second level) make no sense if a person does not know how to start a car engine in the first place. The role of the first, or lowest, level in the hierarchy ("vehicle manoeuvring") is in the theory considered to be **executive** in respect to choices made on levels 2, 3 and 4. For example, the amount of consumed alcohol may make our hypothetical driver to drive straight in a bend as the demands on manoeuvring skills become too great on the winding road. On the other hand, an appropriate

choice e.g. regarding speed makes driving manageable in slippery conditions despite weaker manoeuvring skills.

Focus on this level is on the vehicle and its properties, and on the interaction between the driver and his/her car. Emphasis is on skills that have to do with vehicle control and handling. This includes not only basic skills such as knowledge of controls, driving off, braking, gear changing, etc., but also more complex knowledge such as keeping the car under control, evasive manoeuvring, understanding the concept of traction, the impact of seat-belts, use of rear-view mirrors, etc.

## **The hierarchy is more than its parts**

As was already outlined in the beginning of this chapter, the levels are interdependent but not equal. Higher level goals and motives always override skills and considerations on lower levels. Skills are often applied beyond the limits and safety is put aside for other considerations that are perceived more important. Such considerations are for the most part made subconsciously and may be very remote from the actual driving situation. For example, a young male driver who is very enthusiastic about cars and driving, and focuses on these interests as a central way for building up his identity, is likely to select his driving context according to this motivational orientation (a choice on level 4, the highest level). It might also lead to certain qualitative properties of exposure where the driver is looking for opportunities to show off, such as driving at night with friends (level 3). This inevitably affects the demands and selection of inner models for mastering traffic situations (level 2). The strategy might be for example to maintain as high speed as possible in all situations. High speed driving, in turn, increases the strain on the information processing with the risk of overloading the processing capacity and this may in turn lead to misjudgements or other mistakes in traffic situations. High speed also increases the demands on vehicle manoeuvring (level 1). The driver thus selects a certain vehicle manoeuvring style and a driving strategy according to his or her motives or goals, in this case the motive to impress overrides the motive to drive safely.

Another example could be a driver with a safety-oriented strategy and a neutral approach to driving. This kind of motivation is likely to lead to moderate speed and perhaps even to a decision not to drive. These kinds of processes could easily be imagined to be present in e.g. female drivers with little experience in driving or elderly drivers. If a driver feels worried about his or her skills for coping with difficult road-conditions, is willing to maximise safety, and has no self-enhancing ambitions connected with driving, a safe way of operation is easily adopted. This leads to a less demanding driving task at the lower levels of the hierarchy and the trip will most likely be safe, even though the absolute skill level in e.g. manoeuvring may not be perfect.

Although the two examples may seem to represent extreme ends of a continuum, where the average driver is somewhere in the middle, they may be observed when we try in accident investigation to reconstruct the processes that led to the accident. The examples are intended to highlight that success or failure on a higher level affects the demands on skills on a lower level. Some important implications may be drawn from an educational point of view:

- Skills in manoeuvring are important and should be taught well.
- Motives and other higher level guiding mechanisms should also be addressed.
- Although it is easier to teach, and maybe more fun for the learner driver to learn, basic driving skills, the positive effects of this learning are likely to last longer if higher level preconditions are addressed also.

TOTE-operations (cf. above) are done on every level. Possible ways to do things and their outcomes are pondered upon all the time. But the degree of freedom (the amount of choices available) gets more limited as further down in the chain we go (Hacker, 1980). For example, someone planning a happy evening visiting all the city pubs with friends has many choices available to start with. He or she may choose to go by car, by bus, walking, persuade a tea-total friend to act as a driver, and so forth. Whatever choice is made, it affects consecutive choices at a later stage. If this person chose to use his or her own car after all, he or she might face a dilemma when deciding how to get home again after the round. The number of alternatives in the chain from start to finish, e.g. during a trip to the pub from planning to finally getting home, lessens after each choice we make and heightens the demands lower down in the hierarchy. If he or she chooses to take the car, there will not be the same degree of freedom to drink in the pub. A wrong choice is perhaps made there, too. He or she drinks too much and decides to drive home again in spite of that, the demands put on his or her skills for coping in traffic may be too great, with e.g. a basic manoeuvring error at the end of the chain.

It is easy to understand why several attempts to improve safety by improving skills at the lower levels of the hierarchy have actually failed to decrease accidents. Negative safety-effects have e.g. been obtained when improving skills in vehicle handling on slippery road (Christensen & Glad, 1996; Glad, 1988; Keskinen et al., 1992; Katila et al. 1996). If increased skills, or even worse, imagined increase in skills (Gregersen, 1996a) are used to satisfy needs for maintaining as high speed as possible, the results are very likely to be negative. If the motivational level fails to produce a safe strategy for driving, no level of skills in mastering traffic situations or vehicle handling is high enough to compensate for this lack of safety orientation and to produce a safe output.

A positive influence (e.g. an exercise in driving school) will produce a positive result only if the higher level preconditions are equally positive. Or, a negative influence (e.g. social pressure) will lose its power if the higher level preconditions provide a positive counter-force. The goals and motives of a driver may either increase or decrease the level of risk.

The contents on the two lower levels are easy to grasp by learners as well as instructors. The things covered on these levels are technical in nature and by and large equal to "everyman's" notion of what driving is about, and what driver training and education have traditionally focused on. The third level already focus on matters of a more abstract nature than the previous two. The level of abstraction increases further when we come to the highest level. This level is clearly distinct from the other three in that its content is **already established before a person begins driver education** and most of its content is subconscious, affecting by and large everything a person does. It is therefore not readily accessible to change through traditional education as its already internalised pieces of knowledge and beliefs provide a kind of counter-force which influences what is being taken in from the information provided, how it is understood, and how it is implemented. The power of this counter-

force becomes clear if one considers e.g. how strongly ardent smokers oppose any new information regarding the hazards of smoking.

As far as driver training is concerned, the hierarchical perspective demands a wide range of methods in teaching / instruction. Skills for vehicle manoeuvring and mastery of traffic situations are the basis for successful operation in traffic and these aspects should be learned well during driver training. Psychomotor and physiological aspects are important as basic requirements for operations at the lowest levels of the hierarchy of driver behaviour. However, as has already been underlined, the skills that are applied and the choices that are made at the lower levels are under guidance of goals and motives on the highest level. The driver selects the style of manoeuvring and the driving strategy in a certain situation according to his or her goals. In addition to the training of basic skills, driver training should also deal with the higher levels in the hierarchy and take into consideration the driver's goals connected with driving and for example skills for dealing with social pressure during a trip. Training that is targeted at the lower levels only will limit itself to just a narrow part of the total concept of driving. In order to be safe, a driver should therefore not only be **skilled** but also **aware of potential risk factors** and his/her own **abilities and motives** as a driver. One might compare the qualities of a safe driver to those of an "expert". What distinguishes the skilled expert from a competent amateur is the ability to reflect upon one's own behaviour in a global sense, learn from this, and draw appropriate conclusions. The end result might be a slight paradox from the point of view of driver education: the driver may decide that driving is unsafe no matter what degree of skill has been obtained, and choose not to drive at all.

## **CONTENTS AND GOALS OF DRIVER EDUCATION: A FRAMEWORK**

The four-level hierarchy was expanded within the scope of the EU-funded project "Gadget" (1999) to a framework so that **knowledge and skills, risk increasing factors, and self-evaluation (self- assessment) skills** were included and linked to the four levels (table 1). Thereby it became possible to create a structure for defining what should be focused on in driver training. From here on this framework will be referred to as the "Goals for Driver Education" framework, GDE. The framework can be used as a basis for evaluating specific driving education methods. It is intended to be a tool for evaluation of driver education methods along two dimensions at the same time.

The cells in the GDE-framework are used for defining detailed competencies that are needed in order to be a safe driver. It is a description of driving in general and it is not entirely suitable for describing the behaviour of some particular driver.

Table 1. Goals for Driver Education -framework

Hierarchical level of behaviour (extent of generalisation):	Central content of driver education:		
	Knowledge and skills the driver has to master	Risk increasing factors the driver must be aware of	Self-evaluation
Goals for life and skills for living (global)	Knowledge about / control over how general life goals and values, behavioural style, group norms etc. affect driving.	Knowledge about / control over risks connected with life goals and values, behavioural style, social pressure, substance abuse etc.	Awareness of personal tendencies re. impulse control, motives, lifestyle, values, etc. Developing self-evaluation skills.
Goals and context of driving (specific trip)	Knowledge and skills re. trip-related considerations (effect of goals, environment choice, effects of social pressure, evaluation of necessity, etc.).	Knowledge and skills re. risks connected with trip goals, driving state, social pressure, purpose of driving, etc.).	Awareness of personal planning skills, typical driving goals, driving motives, etc. Developing self-evaluation skills.
Mastery of traffic situations (specific situation)	General knowledge and skills re. rules, speed adjustment, safety margins, signalling, etc.	Knowledge and skills re. inappropriate speed, narrow safety margins, neglect of rules, difficult driving conditions, vulnerable road-users, etc.	Awareness of personal skills, driving style, hazard perception, etc. from the viewpoint of strengths and weaknesses. Developing self-evaluation skills.
Vehicle manoeuvring (specific task)	Basic knowledge and skills re. car control, vehicle properties, friction, etc.	Knowledge and skills re. risks connected with car control, vehicle properties, friction, etc.	Awareness of personal strengths and weaknesses re. basic driving skills and car control (especially in hazardous situations), etc. Developing self-evaluation skills.

## Central content of driver education: Describing the columns

### Knowledge and skills

The first column ("knowledge and skills") in the framework (Table 1) describes what a good driver needs to know at each level in order to drive a vehicle and cope in normal traffic circumstances. This includes e.g. how to manoeuvre the car, how to drive in traffic, what rules must be followed (lower level skills), how trips should be planned and how personal preconditions influence behaviour and safety (higher level skills). The term "knowledge" encompasses both practical and theoretical knowledge.

Especially the lower half of this column is familiar to the traditional notion of driver training, where basic knowledge of e.g. traffic rules, manoeuvring and driving in different traffic situations are typical contents. However, some of the contents on the highest two levels of the hierarchy are not typically included in driver training curricula, although they are increasingly being considered in various post-licence training programs (Advanced, 2002).

When it comes to the two highest levels, the aim in driver training should be to introduce the driver to the concept of driving as **a skill that goes beyond the interaction between man and machine**. Success or failure thus follows mainly from a person's motivational characteristics and the driving strategy he or she chooses.

### **Risk increasing factors**

The second column in the framework ("risk increasing factors") is closely related to the first column but it emphasises particular knowledge and skills related to factors that increase or decrease risk. The content in the second column stands in its own right because of the importance of these factors for safety. They must in practical driving school education be **integrated into teaching of general skills and knowledge** (first column). Typical risk factors are emphasised and described in more detail. Not only do the risks referred to here connect **directly** to a certain driving situation (e.g. the effects of ice and snow, or worn-out tyres) but also **indirectly** (e.g. social pressure or life-style). The risks are thus different on different levels of the hierarchy. The frequently used concept "hazard perception" is a good example to be analysed. By using the GDE-framework it is easy to see that the traditional idea of hazard perception as "road-craft" appears rather limited.

There are potential hazards at all levels of the hierarchy the driver needs to be able to recognise, such as risks related to type of the trip or personal motives or behavioural tendencies. In driver education in practice, traffic-related risks can hardly be treated separately from the skills that are being taught: every particular risk has to be tied to some body of experience. **Skills and risks can therefore not be separated in driver education**. The reason why risks have been emphasised in the framework has simply to do with their importance.

Several studies have shown that, on a general level, deliberate risk-taking, violation of rules, underestimation of risks and overestimation of personal abilities are common features of young drivers, especially young males (e.g. Jonah, 1986 and 1990; Keskinen, 1996), and that such behaviour lessens with age. However, as Jessor (1987) and Twisk (1994a) point out, this type of behaviour also has a functional dimension as a part in the maturation process towards adulthood. Driver education should be able to address both these dimensions, a task in which it has not succeeded fully in any country as evidenced e.g. by the speeding and drink-driving accidents of young male drivers. At least, **driver education should not encourage the already existing risk-taking tendencies e.g. by focusing on training of skills alone**.

As was already noted, the columns "knowledge and skills" and "risks" overlap to a large degree. As far as driver education is concerned, a distinction should be made between training of skills (first column) and training of risk-awareness (second column). Skill-based training is primarily about learning vehicle control and manoeuvring. Risk-awareness exercises, on the other hand, are designed to increase knowledge, experience and recognition of dangers on the road. The message and focus is entirely different in these two types of exercises, although they resemble each other. As a general rule, any training of skills should be combined with or followed by training to raise awareness of the risks involved with the use of these skills. As already mentioned, skill-based exercises have had a risk increasing

effect in certain circumstances. Avoiding overconfidence is therefore one of the main targets of influence.

## Self-evaluation

The third column ("self-evaluation") is a central and essential element in modern pedagogical thinking. Self-evaluation<sup>4</sup> might be defined as a process whereby an individual tries to get feedback on his or her personal actions from within the self. In the context of driving it is a matter of becoming, or wanting to become, aware of **personal preconditions and tendencies as well as skills and abilities regarding manoeuvring, coping in traffic, planning of driving, and life in general**. In short, being able to perceive realistically different factors that have an influence on driving, and the importance of one's own actions and motives in the process.

Not only is self-evaluation seen as an important tool in driver training but also in development of driving skill after training. Research on the development of expertise show, that meta-cognitive skills and reflective thinking<sup>5</sup> are essential characteristics of an expert (Kolb, 1984; Mezirov, 1981). The power of reflective thinking was exemplified vividly in a study on the motivation to use contraceptives (Richard, van der Pligt & de Vries, 1996). In this study, three groups of students were "educated" regarding the risk of getting a venereal disease. One group received information about the risk of getting such a disease, the second group received information about its long-term effects, and the third group was instructed to imagine what it would feel like to wake up in the morning after having had unprotected sex with a temporary partner. A behavioural change, measured later, was apparent only for the members in the third group. This shows that information or knowledge as such is important but not sufficient if it is not personalised.

However, self-evaluative skills do not develop automatically but should be included as part of training. Abilities for self-evaluation also have relevance for driving behaviour. For example, a driver who is aware of a tendency to doze off during driving, or of having limited skills for driving in slippery road conditions, may be able to take these factors into consideration when driving. Similarly, on a higher level, a driver is expected to benefit from intrinsic knowledge of what effect personal motives and goals have on behaviour in a driving situation, e.g. poor abilities to resist social pressure. Educational methods that might be appropriate to increasing driver's skills for self-evaluation include e.g. improved **feedback** during training, self-evaluation tools like **questionnaires and scales, discussions** with other drivers about personal experiences and **evaluations** made by instructors or examiners. One useful method might be to ask learners beforehand about their conceptions and expectations. The aim would be to be mentally prepared for the lessons or exercises to follow, with increased learning as a result.

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<sup>4</sup> Similar terms denoting more or less the same thing are reflective thinking and self-observation. However, self-evaluation in this context includes more clearly the idea of qualitative self-assessment of performance.

<sup>5</sup> The two terms, meta-cognition and reflective thinking, are related. Meta-cognition refers to being aware of one's own internal or mental processes as they take place. Reflective thinking occurs when we think about a previous experience or event and its significance.

There is evidence that it is possible to have at least some effects on alcohol-related violations and other traffic violations with appropriate educational methods. For example in Germany, driver improvement methods have been widely used and evaluation studies have shown reduction of recidivism after course participation (e.g. Bartl & Stummvoll, 2000). The educational methods used in driver improvement courses are largely based on self-reflective and self-evaluative processes and even therapeutic elements are included.

**Teacher-knowledge or learner-knowledge?**

When a young person wants to learn to drive a car, the expectations will likely be that the driving school will teach him, or her, a technical skill like working a machine. This is the popular and still prevailing notion of driving, upheld by the car industry, films and media. Driver education began with the dawn of motoring and developed, roughly described, from "what is a car and how does it work" through "how does a car work and how should it be driven" to "how does a car work and how should it be driven safely". In other words, basic driver education has in the main focused on the down-left diagonal half of the framework, i.e. technical skills, manoeuvring, legislation, etc., and associated risks (Fig. 2). The connection between driving and life outside the car, personality and motives, i.e. the highest level and the upper-right half of the framework is still in its infancy at least in basic driver education. It has, however, been applied in various types of post-licence driver training. This is the "fourth stage" in the evolution of driver education, or "what does driving mean and what does it mean to be a driver".

The degree of "teacher-knowledge" versus "learner-knowledge" in a certain matter depends on its nature and the contents of education. Considering the GDE-framework, it is clear that roughly the lower left half encompasses special knowledge possessed mainly by the teacher to be given to the learner driver, the exclusiveness of which being greatest in the square marked "T" (figure 2).

	Knowledge and skills	Knowledge of risks	Self-evaluation
Life goals and skills for living	L		
Driving goals and context			
Mastery of traffic situations			
Vehicle manoeuvring	T		

Fig. 2. Relationship between "teacher-knowledge" and "learner-knowledge".

The white areas in Fig. 2 correspond to knowledge that stems more from the learner driver's own life and experiences, including the special experiences acquired during driver training so far. This is greatest when it comes to the content of the square marked "L". The white areas are also the ones that traditional teacher-centred learning methods leave out to a lesser or higher degree. The role of the teacher



changes when moving from to the right and upward. The role changes from one who provides information to one who has a **tutoring** role, who asks questions and encourages the learner to think over or evaluate his or her existing pieces of knowledge (including the information provided by the teacher). The instructor's role is to point out things for the learner to make the connection.

The hierarchical view that the abilities (skills) that are applied and the choices that are made at the lower levels are under guidance of higher level preconditions, implies that driver training should cover as much as possible of the whole framework if it is to be truly effective. Modern cognitive psychology and pedagogy does not deny the importance of facts and information. However, they stress an individual's own motivation as a driving force of behaviour, and the importance of being aware of the implications thereof. Mere knowledge of e.g. risks is not enough if these risks are not perceived intrinsically important. Feedback, self-evaluations, and other thought-inducing methods must therefore be employed. Such methods have largely been neglected in basic driving school teaching, although the ideas of self-evaluation and reflective thinking have been implemented successfully in e.g. driver improvement programs.

Naturally, there are only a limited number of practical educational methods aimed specifically at the two highest levels in the hierarchy. A wide range of established methods could be used when addressing the lower levels of the hierarchy, e.g. social learning, model learning, learning through repetition, or motor learning. However, the higher we go in the hierarchy, the more we move away from concrete psychomotor and technical skills towards more abstract factors. Higher hierarchical levels call for learning theories and methods that are capable of dealing with motivational and other factors connected with driving strategies, motives, and skills for life. As the hierarchical approach has its origin in cognitive psychology, it is only logical that we should look in the same domain for a suitable approach that could describe the higher levels from the point of view of learning. Such an approach may be found under the label "constructive learning".

## **A constructivistic view on learning**

The constructivistic view defines learning very broadly; we learn for example to fear dogs, to drive a car and speak a foreign language. In all these areas of learning it is common that learning is connected to action, orientation, adaptation, problem-solving and facing challenges (Rauste - von Wright & von Wright 1994). Learning is not an isolated phenomenon, but it is closely intertwined and in interaction with other areas of the learner's life and world. Learning is part of a wider process that includes perceptions, motivation, remembering, thinking and making decisions. It is linked to the learner's motives, cultural and social environment, and relationships. All these dimensions influence the learning process.

**The basic idea in constructive learning is that learning is an active and on-going process where the learner constructs and expands his or her basis of knowledge and skills.** This process is based on and guided by the prior knowledge of the learner. This is in concordance with the central assumptions of cognitive psychology, as outlined above. It also means that people who know a lot about some specific area, and are experts in that area, also learn, remember and understand

more easily than novices who don't have that much background knowledge (e.g. Moran, 1991).

In constructive learning the learner is in the centre of the learning process, and focus is on the learning process (learning strategies) itself and not on domain-specific knowledge (Vermunt, 1995), i.e. providing facts. Emphasis is on the internal processes of the learner, and on the meaning and power of these internal processes for behaviour and behavioural change. **Knowledge is not transferred unchanged from teacher to learner. Instead, the learner constructs his or her interpretations of the teaching based on prior knowledge, experiences and assumptions.**

When talking about learning from a constructivistic viewpoint, we tend to see the learner as a totally active part. But, as discussed by Baddeley (1990), learning can also take place even if there is no intent to learn, or when a situation is not a learning situation as such. Learning of this kind produces "extra" knowledge in addition to the primary, intended knowledge, as a by-product when something is processed mentally. Baddeley (1990) argues that such **incidental learning** takes place at all times, but its quality and retention level is dependent on how the primary learning material is processed. The more the primary material is tied to previous knowledge, and the more the subject has to think about it, or process it from different angles, the more of it stays in long-term memory. If transferred into the present context, we may argue that discussing a topic, for example a track exercise, and self-evaluations might not only be the key to improve memory performance and learning of the exercise itself, but might generate additional knowledge as well. This could then in turn move understanding to higher hierarchical levels.

### **Consequences of the constructivistic view to driver training**

When driving skill is conceptualised as a broad set of skills that are used according to drivers' goals and motives, a need for versatile use of pedagogic methods arise. Questions concerning the nature of learning and the methods likely to be effective at each level of the hierarchy. According to Goldenbeld (1998), there are several theoretical starting points for understanding learning, but there are not many conscious attempts to use different learning principles in the field of driver training. All these views (Stimulus-Response theory, the cognitive approach, information processing theory, as well as views emphasising motivation and personality) may contribute to training. But no single method can alone be expected to cover all levels of the hierarchy of driving behaviour, even though certain features of training may do so. The goals of training and the level that is being focused on should determine the optimal learning method.

Driver training should promote the view of driver behaviour as a multi-level task. The driver's task is not only a complex psychomotor challenge requiring lower level psychomotor skills and abilities, but also an operation (safe or unsafe) that is related to the driver's goals, motivation and strategic planning, as well as skills in self-control. This affects learning goals and the learning exercise, both during training and afterwards.

The training process should start with gaining a certain necessary level of automatism in vehicle manoeuvring (the first level) before proceeding to mastering traffic situations (the second level).

A central choice should be made between "concepts vs. experience" (Advanced, 2002). The traditional approach to training has been to take the concepts first. A topic, or a training session, thus starts with concepts in the form of information and facts (e.g. what skills are needed or what risks there are). Practical exercises then follow, during which the given information is put into practice (e.g. emergency braking or evasive manoeuvres). The third step is discussion (feedback) about the exercise with the aim to integrate it with theory.

However, the problem with this approach is that the concepts, if presented first, often have little meaning as the learner's have no prior knowledge on which they can be tied correctly. In addition, the concepts that are selected in the traditional approach are inevitably assumed to be the ones that the learner needs to know. But this may not be the case in reality as **each individual learner in the classroom has a different set of needs, strengths and weaknesses**. Some learners need information that addresses the lower hierarchical levels, whereas others would benefit more from an emphasis on higher level factors. Furthermore, the instructor also has his or her own perceptual bias. The concepts may therefore be presented in a way the instructor believes is good, and not in a way the learners would need it.

A constructivistic approach would want to work in the opposite direction, so that the **sensory-based experience (practice or exercises) is given first, and the concepts follow together with the feedback**. Once the learner has had the experience, he or she has something to relate the theory to. The feedback is then not only tied to the exercise, but it can also be used to check and facilitate understanding of the concepts.

An example of a trial where track exercises preceded theory is provided by Laapotti et al. in Keskinen et al. (1998). Not only did it become easier for instructors to connect theory to reality as the experiences on the track could be utilised in theory class, but the time in theory class also seemed to be spent on essentials better than before. The only drawback had to do with practical matters, as the total course could not be compressed into one day as previously. This was, however, overshadowed by the improvements in both teaching and learning.

A variant of this approach might be to give the learners an overview, a minimum of concepts, of the topic as a preparation, after which the actual exercises are carried out. The exercises are then followed by classroom activities where they are discussed and tied to relevant concepts. The experience from the exercises and the discussions on and around the issue help the instructor to focus on the aspects that the learners find difficult and need to be clarified. The discussions also serve to enrich the concepts, e.g. by giving different interpretations.

When learning is regarded as a process where the learner constructs his or her knowledge, then the learner's own activity becomes crucial. In other words, the learner **takes active part in the learning process** (Zimmerman, 1986). However, and this should be emphasised, it is not a question of leaving the learner alone to grow like a wild flower, without teaching or guidance. But what the constructivistic approach stresses, is that one should make use of the learner's own resources and

using them as tools in the learning process. The learner should develop his or her abilities to reflect upon the environment, including the education.

This puts new demands on the teacher/instructor, who has to give away some traditional responsibilities and take on new ones. **The responsibilities of the learner are on the one hand increased**, as he or she no longer can remain a passive recipient of information, and instead must take an active part in the process. **The instructor, on the other hand, has the responsibility to tie all new information to what the learner already knows.** Not only should it be tied to what has been learned during previous lessons, but also to what knowledge the learner has gathered in life previously. In other words, "teacher-knowledge" and "learner-knowledge" should converge as much as possible (cf. Fig. 2 above). Naturally, there are in driver education, as in all education, elements of which the learner has no previous knowledge. Or, what he or she knows may be erroneous, based on hearsay and "facts" provided by "well-informed" friends. Or, what has been said during the previous lesson may have been misunderstood.

Furthermore, **the teacher has an overall responsibility to make the learner's "goals" come closer the goals set up in the curriculum.** The learner's goals have two basic interconnected dimensions: the first has to do with what he or she believes driving is about, and the other with things that motivate the learner to sit in the classroom of a driving school. There are always learners for whom the goal is to get a driver's licence as soon as possible to be able to get behind the steering wheel of a Porsche and ride into the sunset on the waves of the motorway. Whatever the goals are, they must be addressed by the teacher/instructor as they form the basis of the learner's search for information, understanding, and ultimately his/her learning. They are as it were the foundation upon which the teacher/instructor can add new building blocks provided by the curriculum. This again raises the need for interaction between the teacher/instructor and the learner, or what is commonly known as "feedback". Using the metaphor, we might say that feedback is the cement by which the building blocks of the curriculum are glued to the learner's foundation.

Overall, the methods that are used when teaching, or addressing, something should vary according to the demands of the issue. The higher up in the hierarchy a particular issue is located, the more complex will the education and learning methods be. For example, simply telling and memorising is usually enough when we want to learn the meaning of basic traffic signs, and basic vehicle handling may be learned through demonstrations and practising. But such methods are not sufficient when addressing attitudes and motives. Self-evaluation, discussion and feedback then become the methods to be used.

Feedback is essential when modifying behaviour. As was described earlier, all our actions are performed in a loop-like fashion: goal setting, action, and checking how well the action fits the goals. The actions are then revised if necessary so that they match the desired goals, or the goals themselves may be revised if the experience, i.e. the feedback, gained from the action supports it. Feedback either from within oneself, or from outside oneself thus becomes an essential part of a learning process. Without feedback the learner can not evaluate his or her learning properly and adjust the personal goals if necessary. It is also an essential part in incidental learning, as described above.

Feedback is an effective way to show the learner that he or she is important and valued. Positive feedback also increases self-confidence, and feedback of a critical kind decreases it. Feedback may therefore be used e.g. during a driving lesson to modify self-confidence in either an increasing way ("that went well, didn't it?") or a decreasing way ("that was fast cornering, don't you think?"), and at the same time encourage self-reflection. Finally, feedback that is objective and "matter-of-fact" gives the learner the impression that the teacher is an expert in his or her own special area of expertise.

Feedback is closely connected to evaluation. On the surface level, learning can be evaluated e.g. by observing the manoeuvring skills of the learner (motor performance). On a deeper level e.g. the attitudes or typical ways of reacting can be evaluated according to their functionality from a safety point of view. All levels of the hierarchy should be evaluated and it can focus on different aspects of driving; e.g. safety or mastery of traffic situations. The values of the teacher are important in the evaluation. What does he or she believe to be the essential points in driving (e.g. safety promoting factors or following the traffic rules literally and holding on to one's own rights). Maybe it is worth pointing out that evaluation without feedback probably will lose its effect. There is e.g. little point in saying that a certain performance is bad without pointing out what exactly is bad and giving suggestions for improvement.

Like any other skill, learning of driving skills starts from basic skills located on the lowest hierarchical level and then moves upward towards more complex skills. Learning on levels 1 and 2 ("vehicle manoeuvring" and "mastering traffic situations") is most effective when it starts with manoeuvring skills. Learning on these levels is directly connected to driving and its demands, and forms the basis on which training is built. Learning on the third level ("goals and context of driving") is already more abstract and focuses on mental aspects in a driving situation. The fourth level ("goals for life and skills for living"), finally, is from a learning point of view, most remote from actual driving and connected to life in general. On the two highest levels, learning that increases safety is connected to increased knowledge of oneself, one's own tendencies and more general life goals and life-style.

However, according to the hierarchical view advocated for here, behaviour on the lower levels is under guidance of higher-level goals and motives. The higher levels should therefore also be **addressed at an early stage** so that learning (as well as feedback) on all levels complement and support each other. Furthermore, new information and skills are learned by building on old information, i.e. previous knowledge and personal experiences. As these "**inner models**" guide attention, perception, interpretation and decision making, they **should be activated when new knowledge and skills are to be learned**. Not doing that would be a waste of energy on the part of the teacher/instructor, as activation has meaning also on the motivational level. Things that can be tied to the learner's own previous experiences and interests are more easily perceived relevant and meaningful.

Activation can be done on all levels, e.g. in orientating discussions in small groups about previous experiences concerning the subject matter (e.g. previous experiences of driving a moped, has anyone been in a car that the driver lost control of, thoughts raised during a track exercise, etc.). The main points raised by the learners in a discussion group can be summarised, on the blackboard for example, and the teacher can add things that the learners did not come to think of (e.g. goals from the curriculum) and relate these to the issues the learners brought up. "Non-classroom

tasks", like writing essays or answering a questionnaire, are also good activation methods. Discussions need also not be in the form of lessons, but e.g. in the form of "informal" discussions immediately after an exercise. Although the group size can vary, a session with one learner and a teacher is, however, good from the point of view of personal feedback.

Activation can also be done for diagnostic purposes. Not only does diagnosing activate learners, but it gives the teacher the possibility to find out the starting level, or later also the learning level, of the learners and be of help in adapting the teaching accordingly. The teacher gets useful knowledge, i.e. feedback, about what the learners already know and about the strategies they use in learning and construction of knowledge (e.g. Lonka & Lonka, 1993; Rauste - von Wright & von Wright, 1994). The curriculum should be flexible in the sense that it should permit consideration of individual differences of learners. For example, it has been shown (Laapotti & Keskinen, 1998) that risky driving habits seems to play a bigger role in the fatal loss-of-control accidents of young males, whereas lack of vehicle handling skills seems to be more crucial in the case of females. Such differences could very well be acknowledged, and emphasis put where it is needed. However, flexibility does not imply that important things may be ignored. What it means is that whereas a certain basic dose of X and Y should be given to all, there are among the learners those who need more of X and less of Y, and vice versa.

Social interaction between learners in the classroom or on the track is essential in active learning methods. It gives learners an opportunity to share experiences and thoughts, to give and get feedback. Learners also gain more in a group than they would do alone because discussions with other learners and with the teacher highlights how differently things can be interpreted.

Group training gives a possibility to make use of social interaction processes, e.g. discussion about how others have perceived different situations, what they would have done differently and why. The role of the teacher is to guide the learner to notice these different interpretations as well as the similarities and discrepancies between the issues the learners find important and the issues that are emphasised in the curriculum. Of special importance is that the teacher can guide the learner to notice important and safety promoting factors that might otherwise go unnoticed, e.g. due to inexperience. For example, the learners can discuss a certain traffic situation and compare their interpretations. The teacher can then tie this discussion to a wider context so that the group discusses what implications this phenomenon might have on e.g. interaction and communication in traffic. Apart from noticing the different interpretations learners can also give each other support and encouragement.

Discussions, as well as feedback in general, are valuable also in the sense that they promote the meta-cognitive skills of learners by "forcing" them to self-evaluation and reflection. The learner needs to understand the new information, why something is done, why it had the effect it had, and how it is related to his or her previous knowledge. The idea in both practical training and in the theory lessons should be to motivate learners to question their own ideas and representations, and to consider other possible solutions.

Because learning is an active process where knowledge is constructed, it takes time. It also requires guidance into self-evaluation and information about what is essential and what skills are important to learn. From what has been said above about

experiences being transformed into mental representations or inner models, follows that learning is connected to the specific situation where those experiences are gained. This means that **training should cover the typical traffic situations a novice driver is likely to encounter in order to ensure automatism of inner models** of these situations. Skills or knowledge that are learned in a certain situation can also be used in a different situation through transfer of learning (e.g. Rauste - von Wright & von Wright, 1994).

The transfer effect is dependent on the degree of learning. The more generalised the learned principles are, the easier it is to apply them in other but similar situations. It is therefore necessary to show the learner that the same features and principles are relevant to many different traffic situations. Learning and training should therefore cover a wide range of situations (e.g. driving on rural roads and in city traffic, driving with other learners, in different weather conditions etc.) so that the transfer effect may come into action in situations not previously experienced. For example, on a basic level, when turning the steering wheel on the road, the learner can expect something similar to happen as when he or she did so previously in the parking lot. Another example, of a more complex kind, would be a situation where this manoeuvre (turning the steering wheel) is performed in slippery conditions. If the learner in the first example also has experience from braking on a slippery road, he or she may combine these two inner models into a new and more complex one: how it feels to turn the steering wheel when the road surface is slippery.

The importance of self-evaluation in the learning process has been emphasised here many times. Self-evaluation is, however, not easy. Rather, it is a skill that must be learned and practised. A term which is used in this context is “learning to learn”, which refers to the ability of learners to evaluate their own skills and level of knowledge, in terms of strengths as well as weaknesses. On an extended level, we might say that a learning situation contains not only **learning of new information**, but also, and simultaneously, **learning of the process of learning itself**. This means that attention is consciously directed to goal setting, evaluation of action (including feedback) and modification of action. Learning aids that can be used include apart from discussions, also e.g. logbooks, the idea of which is to guide learners to focus attention on essential features of learning.

Although focus on the learning process may at first glance seem remote in this context, it is essential in the sense that driver training cannot be expected, within its limited time frame, to give more than some basic ingredients for learning of new inner models. The higher up we go in the hierarchy, the longer time it takes to learn the respective models flexibly, get them established and to cover a wide variety of situations. As higher learning must mainly take place after driving school, driving schools should concentrate on providing a firm ground for further learning, a toolkit as it were, so that the first difficult time of independent driving can be embarked upon with thought and hence more safely.

## **Content of curriculum, course or exercise**

Apart from addressing individual topics, the curriculum should take into account the four hierarchical levels of behaviour. Given its limited time frame, it is perhaps not practical to expect driving school to have any fundamental impact on the higher level

behavioural patterns and motives of a person. These deserve, however, to be challenged. One indirect method is the use of self-evaluation as it enhances self-awareness. If the learner gets used to reflect upon his or her own behaviour during driver education, more thought is probably given to the driving process also in life after driving school. Understanding oneself is crucial for the anticipation of potential problems when driving, i.e. for safety.

Apart from moving vertically in the GDE-framework, all topics should also move horizontally. Training of skills (on all levels) should be balanced with training in risk awareness. There is a risk of over-emphasising skill training on the lower levels of the hierarchy. As a general rule, therefore, skill training on levels 1 and 2 should be combined with training / exercises to raise awareness of the risks involved in using such skills. Risks at the higher levels should also be discussed, bearing in mind the ruling influence of these levels on the lower. **Risk awareness training is emphasised here as a means to counteract the pressure of intrinsic personal goals and motives**, which might lead the learner to use the newly acquired skills in a way that is detrimental to safety.

From the hierarchical and constructivistic viewpoints, training should be a combination of on-road, track and classroom activities, and they should ideally complement each other. All have advantages as well as limitations:

### **On-road training**

#### *Advantages:*

- Hazard perception and anticipatory driving.
- Interaction with other road users.
- Learners can observe (sitting in the back) whilst another learner drives.
- The instructor can give a learner individual attention.
- Raising awareness of the variety of different traffic situations in real life.
- Anticipatory and environmentally friendly driving can be exercised.

#### *Limitations:*

- Large groups not possible.
- Risky situations cannot be experienced on demand.
- Driving is normally safe and restricted by the instructor in the car, which may give an overly positive feeling of confidence.

### **Track training**

#### *Advantages:*

- Permits large groups
- Individual experience of specific situations can be emphasised.
- Basic skills can be developed and refreshed.
- Safe environment for first-time exercises and risk-simulations.
- Allows learning of the limits of vehicle, environment and manoeuvring.

#### *Limitations:*

- Unable to simulate a wide variety of real-life situations.



- The actions of other road users cannot be observed (including effect of communication or lack thereof).
- May induce overconfidence if exercises are done without feedback.
- May induce overconfidence if feedback is given in such a way that it enhances skills that may be misused (e.g. "that was a quick reaction and a nice piece of manoeuvring").

## **Classroom activities**

### *Advantages:*

- Basic and general information (e.g. accident scenarios).
- Introduction to practical exercises.
- Rules, facts and information after an exercise.
- Discussion and active learning to train higher level topics (driving context, driver characteristics, behaviour, and motives).
- Attitudes and motives may be addressed.

### *Limitations:*

- If used in isolation or remote from the on-road and track exercises, its usage may be limited for learners who are not inclined towards "lecturing".

It should be pointed out that the word "classroom" does not only refer to traditional theory lectures, but also to group discussions and individual or group feedback and self-evaluations. Feedback and self-evaluations could very well be given on a strip of grass beside the track, or in the back seat of a car, especially directly after an exercise. Also various forms of self-studies, driving log-books, etc. could be used, especially for supporting layman driver education (outside driving school).

The relationship between lectures, discussions, and self-evaluation may be described as follows: The aim of a lecture should be to give basic information on a subject. This information is then discussed in the group so as to broaden the topic and give a social perspective. Misunderstandings can be spotted and handled more easily, and learners may be encouraged to make questions when they see that they are not alone in not understanding. Self-evaluations, finally, gives a personal perspective on the topic, and deepens understanding even further as the information may be tied to other aspects of life.

Following the GDE-framework vertically as well as horizontally implies that a combination of methods should be used. Only through a combination of practical driving, individual or group exercises, and discussion / feedback can all the four levels in the hierarchy be covered. The emphasis on each of these should vary depending on what part of the framework is mainly in focus. Track and on-road exercises should be emphasised when dealing with the lower-left (roughly) half of the framework, whereas the importance of classroom activities and feedback in various forms becomes greater when dealing with the upper-right half. But as the levels are in constant interaction, so must the presence of the other levels be remembered and acknowledged when addressing mainly one particular level. This also implies that on-road training, track exercises, and classroom activities should alternate.

The contents of training should be meaningful and valid not only in training but also in real life. All exercises and discussions should relate to real scenarios that the learners can identify with. They should also be expanded upon to include other scenarios so that the awareness of associated risks is raised. Countermeasures must overall be taken to avoid overconfidence. Overconfidence has been shown to occur:

- When there is too much emphasis on vehicle manoeuvring skills and coping with danger, and not enough on risk-awareness training (including risks connected to the higher levels).
- Where practical exercises are not followed up with sufficient participant-centred discussions, designed to explain and deepen understanding of the message of the exercises.
- When a skill exercise ends in success.
- When there is no connection between the practising and reality.
- When the amount of repetition is great (strengthens the idea of practising).

If a learner is allowed to believe that he or she is a skilled driver who can handle hazardous situations, then these situations are no longer regarded as equally hazardous. These drivers are therefore unlikely to be motivated to drive more carefully than they feel is necessary. Overconfidence occurs easily if not actively counteracted. Methods to avoid overconfidence include:

- Training of a skill, e.g. a manoeuvring exercise, should be followed by exercises and discussions aimed at highlighting the risks involved in using the skill (overconfidence).
- Making sure that a skill-based exercise does not end in success (a gratifying experience).
- Compare the exercises with situations that might be encountered on the road, linking them to reality through the learner's own experiences.

## Summary

What has been said about the hierarchical and constructivistic approaches to driving and learning may be summarised in a checklist of the major points:

### **Learners are not newcomers in traffic:**

- They have expectations regarding the driver training, and established learning patterns.
- They bring along experiences, values and preconditions that affect learning.
- Their preconditions are more or less established notions that are difficult to change through information (teaching) alone.
- They have individual motives for being in traffic school, and competing interests in life.

### **Requirements for learning to take place:**

- The learner is convinced that there is direct personal benefit to be gained by acquiring the knowledge offered in training.
- The training makes use of the learner's experiences.
- The learner feels that the learning activities are relevant.

- The learners are engaged in the learning process.

**Increased responsibility on the part of the learner for his or her own learning:**

- The instructor facilitates learning (tutoring, not just providing information).
- The process of learning to learn (how to learn) is enhanced.

**Quality instead of quantity:**

- Issues are explored and discussed so that they are fully understood.
- The curriculum is flexible and allows more time than scheduled to be spent on issues that learners find difficult, and less time on easier issues.

**Each topic in training consists of three parts:**

- Theory (concepts, facts) = in the classroom.
- Exercises = on the track/road.
- Feedback (discussions, questions, comments) = in the classroom and on the track/road.

**Theory, exercises and feedback should alternate:**

- Sensory-based experience or exercises precede theory and concepts.
- Theory is connected to previous experiences (in driving school and in life in general) and exercises.
- Feedback relates to what has just been practised or learned.
- The connections between the levels are made clear.

**The course content should:**

- Address all hierarchical levels.
- Balance skill training with exercises in risk awareness and self-evaluation.
- Combine on-road, track and classroom exercises.
- Be relevant to real life.
- Avoid overconfidence.

## **THE GDE-FRAMEWORK AND DRIVER EDUCATION**

In this chapter, the four-level hierarchical model of driving behaviour and the three contents and goals for driver education are connected and scrutinised level by level. The aim is to describe the essential contents of education at each level. It should be stressed, though, that **the levels are separated for practical reasons only**. In reality, the behaviour and success of a driver in a driving situation is the end result of a continuous interplay between the driver's motives, knowledge, skills and meta-cognition on all four levels. All the levels should be addressed in training. Learners should also be made aware of the important risk factors at each level. Most importantly, regardless of the level on which a particular topic or exercise is focusing, **the relevant connections to the other levels should be made clear**. The highest level is crucial in this respect, for reasons described above. This level is obviously difficult to access directly through an exercise on the track/road. Methods that encourage to self-reflection over one's own behaviour will be needed instead, e.g. social simulations or group discussions.

All the things in all of the boxes are important for safe driving, but some parts of the content are easier to teach and learn than other parts. The balance between the teacher-instructor's role and the role of the learner driver changes when we move from left to right or upward in the framework: the learner's role increases and the instructor's decreases in relation to this. A further matter is that learning is individual. This is of course due to different experiences and the previous learning history. The contents of the various boxes are to a higher or lesser degree difficult for different groups of learners. Individual adapting of education would naturally be ideal, although it is hardly practical from a resource point of view. A suitable solution is found in the third column in the framework. Using discussions and self-evaluations, the instructor may not only clarify the issue at hand, but it can be diversified and the needs of individual learners can be addressed.

The demands that should be put on education increase from left to right and upward. The highest level in the framework (goals for life and skills for living) deals with things that have evolved during the 18 years before driver training and they are therefore quite stable structures difficult to affect. The accidents of young drivers, especially young male drivers, follow to an alarming extent from problems that may be attributed to the upper half or the right-hand corner in the framework. The driver has not recognised the risks connected to a certain lifestyle and certain motives, or he or she has not been able to control these in the situation, or he or she just does not care. It is not a question of lack of knowledge as such, i.e. something that could be corrected through information, but rather a lack of skills for self-reflection on one's own behaviour.

This description moves from the most concrete lower level (vehicle manoeuvring) to the most abstract highest level (goals for life). This follows the order in which new things are taught and learned in driver education. However, a reminder might be in order here regarding the idiosyncratic character of the highest level. It has been emphasised many times in this work that behaviour on the lower levels is under guidance of goals and motives on the highest level. These motives, goals and self-images are thus the primary targets for measures aiming at modifying behaviour. In theory, it would probably be possible to modify these through direct feedback from lower levels, although it would probably require a profound experience, e.g. a loss-of-control accident in which a will to show off cannot be denied by the driver as being the cause. It would not be easy to produce such experiences in driving school, however. There are indirect methods, however, which will be expanded upon later in this chapter.

Special emphasis is put in the GDE-framework on the concept of risk. Although the various risk factors are presented in a column of their own separate from knowledge and skills in general, it does not mean that risks can be treated separately in practical driver education. The aim is to emphasise that there are specific risks involved on every level, and these should be addressed whenever the learner is taught a new or improved skill (the left column).

Overall, the hard distinction between the three columns serves theoretical purposes only. **Teaching skills, acknowledging the risks involved in these skills, and self-evaluation on the personal aspects of these skills and risks, should alternate and complement each other in practice.** Similarly, when trying to find suitable training methods, it becomes difficult and in fact quite unnecessary to make a hard differentiation between the various levels, i.e. pinpoint only one level at a time. This

applies especially when dealing with the two higher levels, levels 3 and 4, as these are so closely interconnected. Consequently, the examples presented below of suitable methods should be regarded as simplifications, and a combination of methods will have to be used in practice.

## Level 1: Vehicle manoeuvring

Hierarchical level of behaviour (extent of generalisation):	Central content of driver education:		
	Knowledge and skills the driver has to master	Risk increasing factors the driver must be aware of	Self-evaluation
Vehicle manoeuvring (specific task)	Basic knowledge and skills re. car control, vehicle properties, friction, etc.	Knowledge and skills re. risks connected with car control, vehicle properties, friction, etc.	Awareness of personal strengths and weaknesses re. basic driving skills, car control (especially in hazardous situations), etc. Developing self-evaluation skills.

The first and lowest level in the framework is focusing on **the vehicle and its properties**, with emphasis on skills that have to do with **car control and manoeuvring**. This includes not only basic skills such as knowledge of controls, driving off, braking, gear shifting, parking, etc., but also more complex knowledge such as keeping the car under control, evasive manoeuvring, free space requirements, understanding the concept of traction, etc. Driver education on this level focuses in a sense on the **interaction between driver, vehicle and the physical environment** in a more direct sense than on the other levels.

Vehicle manoeuvring is the traditional cornerstone in driver education. Although goals and motives on a higher level have been emphasised throughout this paper, the importance of basic vehicle manoeuvring skills should by no means be underestimated as they have an executive role in relation to the higher levels. The components that are found on this level can basically be learnt through repetition. Bit by bit, from single items to combinations, from basic to complex, and in different settings and on different road surfaces. Basically it is a question of motor learning, of doing things over and over again until they can be done automatically without conscious effort. Sufficient repetition is needed in order to achieve automatism of performance.

Automatic execution of manoeuvring tasks is crucial for safety. The more conscious effort a driver has to put into basic manoeuvres, e.g. the task of changing gear, the less capacity is available for coping with sudden, maybe dangerous events in a driving situation (a skill located on the next level up). If the basic manoeuvres are not performed automatically, the manoeuvring will strain information processing and leave less capacity to observe and predict the behaviour of other road users. The problems at this level partly relate to problems of information overflow in novice drivers. They are well described in earlier hierarchical approaches to driver skills (Michon, 1985; Mikkonen & Keskinen, 1980; van der Molen & Bötticher, 1988) and in the literature about learning of skills (e.g. Fitts & Posner, 1967).

In addition to the skills needed in normal driving situations, the driver should be aware of typical mistakes when accelerating, decelerating and steering, that can lead to loss of control of the vehicle. It would not be possible to avoid making such mistakes without knowledge about them.

## **Knowledge and skills**

The first column on level 1 focuses on how to use the car and its controls in a technical sense. The issues to be covered include:

### Use of vehicle controls

- Basic mechanics.
- Starting the car.
- Applying the clutch.
- Gear changing.
- Braking (foot and hand brake).
- Sitting position and seat adjustment.
- Adjustment of rear-view mirrors.
- etc.

### Knowledge of vehicle properties

- Tyre grip and friction.
- Front wheel drive vs. rear wheel drive.
- Manoeuvrability and stability.
- Effect of in-vehicle load (on e.g. stability or fuel consumption).
- etc.

### Control of driving direction and position on the road

- Driving straight.
- Keeping car in lane.
- Turning.
- Under-steer or over-steer.
- Reversing and parking.
- Need of free space around the vehicle, turning radius.
- etc.

As far as educational methods are concerned, fairly simple training methods, traditional practising in the car and repetition, probably produce good results. Appropriate timing of exercises should be emphasised: different aspects of training should follow in logical order and support each other. For example, there is little use in trying to teach coping in traffic situations (level 2) if the has not yet acquired automatism in basic vehicle handling.

## Risk increasing factors

Risk increasing factors connected to vehicle manoeuvring include:

- Technical faults of vehicle (e.g. neglect of car maintenance, insufficient tyre pressure).
- Insufficient manoeuvring skills.
- Misunderstanding of vehicle dynamics and properties.
- Unsuitable speed adjustment.
- Human reaction times.
- Non-use of seatbelts and other safety devices.
- Blind spots (not checking surroundings before driving off, mirrors).
- Improper seating posture.
- Effect of load.
- Over-reaction, under-reaction, wrong reaction.
- Over-steer, under-steer.
- Effect of different braking techniques.
- etc.

Training of basic manoeuvring skills should, and this is emphasised in the GDE-framework, always be performed in such a way that the learner becomes aware of the risks involved. The view presented here emphasises adoption of a driving style based on foresight and avoidance of risky situations. Training of manoeuvres such as braking, skidding and avoidance of obstacles should then serve the function of making clear the implications of emergency situations for physical risk (personal as well as other road users).

One should generally give experiences from a wide variety of different situations, e. g. different road surfaces. The idea should be that the learner becomes aware of the risks involved in working the car as a machine but also, and most importantly, when manoeuvring this machine.

Apart from increasing risk-awareness on a general level, one primary aim should be to address the question of overconfidence. Learning of skills in vehicle handling and manoeuvring, if left at that, may give learners a false sense of capability, that risky situations can be mastered. The main aim of risk-awareness training should therefore be to show learners the reverse side of the coin:

- Make learners understand that being able to avoid critical situations is more important than trying to handle them (whereas a skilful driver knows how to make an evasive manoeuvre in an emergency, a safe driver knows how to avoid getting into such an emergency in the first place).
- Make learners realise the difficulty of performing certain manoeuvres in practice (e.g. that the laws of physics apply no matter how skilled you are).

The following risk awareness exercise exemplifies these points (Hans Löfgren at the Gillingebanan training centre, Sweden, in *Advanced*, 2002):

Let learners experience an overtaking manoeuvre that fails. The goal is to make the learners aware that if they put themselves into such a situation, they will not be able to handle it whatever they do. On the track, the participants can try an overtaking technique that is common on dry roads, but quite dangerous in slippery conditions.

Let the participants enter the track at modest speed, accelerate to about 50 km/h, steer past an obstacle and then try to get the car back in the proper lane again. Doing that, the car will start sliding uncontrollably. If possible, the same exercise can be done both with a front wheel drive car and a rear wheel drive car.

Before the exercise, the learner is told that he or she should try to handle the situation. The **supposed goal is thus regaining control of the vehicle**. But the real aim is to experience a failure, or **show how difficult regaining control is in reality**.

As the example above highlights, exercises that are only aimed to show how to control a vehicle in an emergency should be avoided. A "danger-exercise" should also not be performed more than twice - otherwise it may become "fun" and the safety message will be lost. Experiencing a failure, e.g. spinning, may also be fun in itself, and the connection to real-life consequences may not be realised in the safe environment of the track, if these are not pointed out explicitly e.g. during a feedback session.

Overall, training of vehicle manoeuvring skills may produce non-desirable effects. As described above, skills in vehicle manoeuvring are used according to the driver's motives. Improvement of basic vehicle handling skills will probably have positive effects on the driver's possibilities for safe driving. However, training of manoeuvring skills seems to bear a possibility for misuse or development of overconfidence in technical driving skills (e.g. Peräaho et al., 2000). Driver training should obviously not create the impression that the driver's task is mainly a manoeuvring task. Teaching vehicle manoeuvring is in that sense a challenge for driver education.

Manoeuvring exercises are generally "fun" in themselves. A learner is on the whole motivated to perform manoeuvring tasks and learning is generally fast, which adds to the feeling of competence. Constant self-evaluation of one's own abilities is therefore needed, as well as realistic feedback from the instructor.

## **Self-evaluation**

Self-evaluation on this level is to a high degree about making connections between action and outcome of that action. When talking about manoeuvring, this insight closely connected to the concept of risk-awareness, or "why am I doing X in this way and not in that way" and "what did I do to make the car go so and so". The idea should be that the learner reflects upon the risks involved in working the car as a machine but also, and most importantly, when manoeuvring this machine. Learners could also be encouraged to reflect upon such things as e.g. the "showing-off" aspect of vehicle handling. An added bonus of this increased insight is that viewing a topic from different angles works as a reinforcement of the knowledge itself.



This column is concerned not only with evaluating and giving the learner a realistic picture of his or her personal strengths and weaknesses regarding vehicle manoeuvring. More importantly, it provides **an opportunity to connect basic manoeuvring with behaviour on the other levels**, mainly level 2, but also 3 and 4.

Focus should also be directed on the topics that the learner finds difficult or feels insecure about. Realistic feedback from the instructor becomes crucial. But emphasis must also be put on the things that the learner finds all too easy to do so in order to avoid development of false overconfidence. Emphasis should be put on what risks may be present through the learner's personal habits and way of doing things.

For example: After the track-exercise described above, the instructor and all the participants come together on the track and discuss what a situation like the one they just experienced would have been in reality. In real life, they would most certainly have driven at a higher speed. What would their chances have been at 100 km/h considering that the manoeuvre failed already at 50 km/h? Such risk-scenarios or mental simulations can be made using different parameters: different speeds, different road surfaces, or the effect of peer pressure vs. personal abilities and worries on speed. Differences between front-wheel and rear wheel drive, or four-wheel drive can also be discussed, as well as overconfidence and under-confidence.

If possible, the participants are allowed to see examples of real accidents of cars using the same speeds that were used on the track (real cars or photos). They can e.g. also discuss their own frightening experiences as a passenger (in the family car / with friends).

Likewise, post-exercise discussions can be aimed at highlighting that skidding is a result of a mistake at some level of behaviour, and that avoiding the mistake is better than getting into such a situation.

## Level 2: Mastery of traffic situations

Hierarchical level of behaviour (extent of generalisation):	Central content of driver education:		
	Knowledge and skills the driver has to master	Risk increasing factors the driver must be aware of	Self-evaluation
Mastery of traffic situations (specific situation)	General knowledge and skills re. rules, speed adjustment, safety margins, signalling, etc.	Knowledge and skills re. inappropriate speed, narrow safety margins, neglect of rules, difficult driving conditions, vulnerable road-users, etc.	Awareness of personal skills, driving style, hazard perception, etc. from the viewpoint of strengths and weaknesses. Developing self-evaluation skills.

Focus on the second level is on competence that has to do with driving in certain traffic situations, in different conditions, and amidst other road users. This level can be described as a tactical level (as was done in earlier hierarchical approaches, e.g. Mikkonen & Keskinen, 1980; van der Molen & Bötticher, 1988) as it is related to the negotiation of traffic situation and road designs. A driver must be able to anticipate

and adjust his/her driving in accordance with the constant changes in traffic. Knowledge of **traffic rules**, **speed adjustment**, **observation**, **risk perception**, and **interaction** with other road users are typical contents at this level.

**The skills learned on the level 1 (vehicle manoeuvring) are now applied in practice.** The concept of speed is extended to cover appropriate use of speed, gear shifting is trained in various situations, the car is kept under control on different road surfaces and in different driving conditions, and so forth.

Mastery of traffic situations is a challenge for driver education in much the same way as vehicle manoeuvring in general. The driver has to adapt his or hers individual behaviour to the behaviour of other road-users and to the traffic environment. It follows that he or she must not only be able to perceive and predict what other road-users will do, but also make his or her own behaviour predictable to them. Knowledge of traffic rules and behaving according to them is one important part of the skills on this level.

An essential problem at this level for novice drivers is that insufficient skills and insufficient automatism result in information overload and mistakes or less appropriate strategies, e.g. in observation or allocation of visual attention (Mourant & Rockwell, 1972; Wikman, Nieminen, & Summala, 1998), and longer reaction times (Quimby & Watts, 1981). In addition to skills needed in normal situations, good skills for mastery of traffic situations include skills for risk-recognition in problematic situations.

Excellent skills for mastery of traffic situations are not necessarily enough for safe driving. The hierarchical perspective emphasises that behaviour in specific traffic situations is related to the driver's general tendencies and goals of the trip at hand. The high interest in cars and driving traditionally exhibited by males does not lead to lower crash rates even though it may lead to higher levels of skill and knowledge (Evans, 1991). Training courses focusing on technical mastery of traffic situations, and on producing relaxed and confident drivers, may make drivers insensitive to fear in risky situations (Job, 1990). Increased technical skills are likely to lead to increased self-confidence so that the driver takes on more difficult driving tasks such as driving faster, overtaking in heavier traffic, or accepting additional secondary tasks, rather than simply to an increase in safety (Evans, 1991).

## **Knowledge and skills**

- Appropriate use of vehicle controls in varying situations.
- Speed adjustment.
- Driving path.
- Driving order.
- Distance to others, safety margins in all directions.
- Knowledge of traffic rules and ability to apply them.
- Anticipating the behaviour of other users.
- Interacting (negotiating) with other road users.
- Making one's own behaviour known and obvious to others (e.g. clear signalling).
- Anticipating (foreseeing) the development of situations.
- Anticipating the demands of the environment (road conditions, weather).

- Adaptation, flexibility (e.g. giving up one's right of way due to others' mistakes).
- Environmentally friendly driving.
- etc.

Interaction with other road users is perhaps the key component in the skills on this second level. This includes not only communication, but also **anticipation** of the actions of others and adapting one's driving accordingly in advance. This connects to what was said above about being able to avoid conflicts instead of relying on vehicle handling skills to solve conflicts.

Training in real traffic situations obviously follows hand in hand and is more or less simultaneous with training in vehicle handling and manoeuvring. The complexity of the traffic situations that the learner is allowed to encounter is therefore dependent on the level of skill acquired in basic vehicle handling. When moving on from the driving school backyard to driving in "real traffic" among other road users, the concept of risk becomes even more crucial.

### **Risk increasing factors**

Risk increasing factors connected to mastery of traffic situations include:

- Poor weather conditions (darkness, rain, snow, slippery).
- Poor road surface conditions.
- Overtaking.
- Visibility.
- Behaviour of other road users.
- Insufficient safety margins.
- Insufficient automatism or skill.
- Vulnerable road users (pedestrians, cyclists, children).
- Poor hazard perception.
- Poor observation / scanning technique.
- Wrong expectations (misunderstanding of situation, incorrect manoeuvring).
- Information overload.
- Insufficient knowledge of typical accident scenarios.
- A risky driving style (unsuitable speed, insufficient safety-margins, wrong positioning, lack of communication, non-compliance with rules).
- Overconfidence / under-confidence.
- Lack of routine.
- etc.

Risk-awareness is difficult to "teach", as the subject matter is not a physical object that can be taken into a classroom, or a rule that can be written down on the blackboard. It is rather something that must be experienced. This can be done indirectly during driving so that the instructor and the learner discuss at appropriate points what is going on outside the car and its implications for their safety. Or, it can be done through especially designed exercises, as demonstrated by the following example (Sakari Hopia of EuroDriver, Finland, in Advanced, 2002):

A demonstration designed to show the risks of insufficient safety margins involved an exercise where two instructors drive behind each other on the track. The learners are asked to estimate the normal safety margin used by drivers in everyday traffic when the average speed is 50 km/h. The cars then drive one or two rounds using the margin agreed by the learners.

At least one participant is taken as passengers in each car, while the others watch beside the track. The two cars are positioned so that the second car is driving beside the first car but at the same time behind (the margin previously agreed upon). The cars are then driven at 50 km/h maintaining this distance.

At a pre-arranged site (unknown to the learners), the driver in the leading car brakes hard. The driver of the trailing car starts braking when he notices that the brake lights of the car in front are lit up. The cars then make a controlled stop on lanes beside each other so that the trailing car has passed the first car.

This exercise could be done so that a learner is driving the car behind. Although the personal feeling for the situation would increase in this alternative, one drawback might be that the attention needed for manoeuvring of the car would disturb focusing.

An alternative method, used to some extent in Finland, is to use a mechanical device in the form of a "detonator". This device contains two explosive paint charges applied to the car and is activated by remote control. The exercise is done with the learner driving. At a sudden point on the track, the instructor discharges the device. A loud "bang" is heard and a spot of paint is discharged on the track. The learner is instructed beforehand that the noise is the signal to brake. A second load of paint is then discharged when the braking starts to affect the wheels. The idea is that the distance between the two paint spots is easily measured and the effect of speed becomes more concrete.

The above exercises are designed to make learners realise how far a car really goes during the critical "one second" of horror when a dangerous situation has been spotted, and that the concept of "quick reactions" so often used by young drivers does not exist in reality. The importance of combining practising of skills with risk-awareness exercises and discussions (self-evaluation) is evident so as to prevent undesirable training effects.

### **Self-evaluation**

What has been said above about self-evaluation and feedback applies here too. Self-evaluation provides an opportunity to give the learner a realistic picture of his or her personal strengths and weaknesses regarding different aspects of driving. It also provides **an opportunity to put this driving in relation to his or her motives and behaviour on the higher levels.** The hierarchical perspective emphasises that behaviour in specific traffic situations is **related to the driver's general tendencies and goals of the trip at hand** (level 3). Focus should also be directed on the topics

that the learner finds difficult or feels insecure about. Realistic feedback from the instructor becomes if possible even more crucial than before. Emphasis should be put on what risks may be present through the learner's personal habits and way of doing things, i.e. realising the consequences of various situations and actions.

Various exercises should be followed up by discussion, not only in order to clarify things, but also to give a wider perspective on things.

For example: The safety-margin exercise on the track is discussed shortly afterwards. Mental simulations of different scenarios can be performed in the same way as regarding manoeuvring exercises. The concept of "reaction time" may be in focus, and the learners can e.g. discuss whether it is something that can be influenced through training. If such a misconception prevails, the instructor can then settle the dispute by repeating the track exercise perhaps with the most persistent learner at the wheel. Most probably the exercise will yield the same result despite the learner now knowing when to react - i.e. no notable reduction in reaction time.

One very useful training method is that learners plan their driving route independently and drive according to the traffic signs instead of following the teacher's instructions. Feedback can also be given in various ways. The learner can for example evaluate his or her driving performance first (strengths and weaknesses), after which the teacher can give feedback and then they can discuss their viewpoints.

### Level 3: Goals and context of driving

Hierarchical level of behaviour (extent of generalisation):	Central content of driver education:		
	Knowledge and skills the driver has to master	Risk increasing factors the driver must be aware of	Self-evaluation
Goals and context of driving (specific trip)	<b>Knowledge and skills</b> re. trip-related considerations (effect of goals, environment choice, effects of social pressure, evaluation of necessity, etc.).	<b>Knowledge and skills</b> re. risks connected with trip goals, driving state, social pressure, purpose of driving, etc.).	<b>Awareness of personal</b> planning skills, typical driving goals, driving motives, etc. Developing self-evaluation skills.

Level 3 focuses on the goals behind driving and the context in which it is performed, i.e. why a driver is driving on a certain occasion, where and when, and with whom. Included is e.g. planning of driving route and driving time as well as choice of driving state and driving company. Decisions made on this level have important consequences not only for traffic safety, but also for matters such as fuel economy, pollution and travelling comfort. Choices are made e.g. between whether to go by car or walk, driving in rush-hour traffic or not, decisions to drive under the influence of alcohol or stress, etc. All such choices are related to the purpose of the trip and directed by general motives of a higher order. For example, if the personal emphasis of a driver is not on the trip from A to B as such but more on the opportunity this trip

gives him (or her) to show off to friends riding along in the car, then safe driving may become of secondary importance.

Good planning of the trip may make the driving task easy, whereas bad planning or lack of planning can make it difficult. Proper estimation of travel time, selection of the easiest route or the most suitable time for the trip, will not only help the driver to save fuel, but also to encounter less demanding traffic situations and thereby lessen the burden on vehicle manoeuvring skills when actually making the trip. A key aspect of planning is, of course, the major decision to drive or not to drive. Such evaluations should be included in driver training because of their direct effect on both quality and quantity of exposure and therefore on personal risks.

It must again be pointed out that young drivers may be realising their personal motives through their driving. According to Vogel & Rothengatter (1984), "pleasure in driving" made the highest relative contribution to a driver's attitude towards speeding. Motivational factors, e.g. driving for pleasure can also be seen in what type of car a person uses. Male drivers who are interested in driving fast tend to choose fast cars (Hatakka et al. 1994). Those drivers who had the highest level of "extra motives" for car choice also had the highest annual mileage and highest number of violations in relation to mileage. Important extra motives for these drivers, i.e. motives for car choice apart from the need for transportation, were high acceleration, a powerful engine, and a sporty look.

## Knowledge and skills

Basic skills on level 3 are connected with trip-related considerations. These do not only involve the question of how to reach a certain trip goal, but also how to do it in the most appropriate way, economically and safely. The issues to be covered include:

- Route planning.
- Avoiding unnecessary driving.
- Choice of travelling mode.
- Getting information (use of maps, weather forecasts).
- Flexibility (e.g. alternative decisions in case of unexpected roadwork).
- Mean speed.
- Constant speed and varying speed in relation to total travel time and fuel consumption.
- The effects of time pressure and goals of the trip on driving.
- How avoidance of rush-hour traffic affects timetables (and fuel consumption).
- Effect of social pressure on driving.
- Effect of alcohol, stress, and fatigue.
- Motives for driving (incl. "extra motives") and their influence on driving environment.
- etc.

Compared with the two lower levels, the topics on this third level centre to a lesser degree on technical skills as such and to a higher degree on the ability to **drive**

**independently.** Considerations made on this level are usually made before a trip begins, consciously or subconsciously.

The skills applied on this level of the hierarchy can in a way be considered as skills of a more abstract nature, and there can be no hard and fast rules for how the topics should be addressed in driver education. Some aspects can be discussed in class, e.g. calculations and the pros and cons of different travelling alternatives, but these skills can favourably be practised whenever the learner and the instructor is on the road:

For example, when practising highway driving, an additional exercise might be to try to plan the trip in advance. Issues such as time requirements, traffic density, fuel consumption, and similar issues may then be demonstrated and discussed during driving.

Similarly, instead of directing the learner bit by bit ("turn right in the next intersection ... now take the second road to the left..."), the instructor can e.g. tell the learner to drive home, and leave the way-finding to him or her. The learner is thus not doing the exercise as a succession of small trips but as a real trip that has to be planned in advance, and that is often subject to revisions while driving.

An added bonus in the second example above is that the mental workload of the learner is increased, which may reveal shortcomings in e.g. signalling. Confusion and frustration may also occur e.g. if the driver gets lost, resulting in hasty and poor solutions. Such shortcomings may not become apparent in easier "hands-on" driving.

### **Risk increasing factors**

Anticipation of risks at this third level in the hierarchy is connected with knowledge about the necessity of planning and the problems that arise when the driver is not able to plan his or her driving properly. Furthermore, the risks connected with specific goals of the trip or driving context should be known to the driver. If the driver is aware of typical personal goals for driving or habits when encountering problematic situations, he or she could prepare himself or herself for meeting the problems. Risk increasing factors on this level include:

- Stress.
- Bad mood.
- Aggression.
- Fatigue.
- Hurry.
- Unfamiliarity with route.
- Unfamiliarity with vehicle.
- Drinking / drugs and driving.
- Distraction (e.g. use of mobile phone).
- Peer pressure (social context and company).

- Purpose and context of driving.
- Driving environment.
- etc.

The risks on this third level may have to be addressed through problem-solving exercises and self-evaluations. One objective would be to make learners reflect upon the factors that influence planning of a trip, especially from a risk-taking point of view. Likewise, the social context and its effects can hardly be exercised while driving, and such a topic has to be addressed through peer group discussions and exercises. Mental simulations of different scenarios can be performed in the same way as was previously mentioned in conjunction with level 2, for example (Christian Gaudioso of ANPER, France, in Gadget, 2002):

A problem-solving exercise is split into three parts, beginning with a general group discussion on what experiences the participants have had regarding the topics on this third level (as passengers, driving with family or with friends). The instructor acts as the one who writes down on the blackboard. The learners then discuss the risky situations that were identified in the first part of the session. The third part finally involves a problem-solving exercise.

The ideal would be to build the exercise around one or two of the situations that the learners brought up themselves. Pre-prepared scenarios can be used as an alternative. The process is in any case the same: One learner reads a scenario, e.g. "... what a day - up at five and working like hell the whole day. Thank God it's Friday. If only we could have waited 'til tomorrow before leaving! But Susan had to have her way as usual. But then, she is not the one who has to drive - look at her now, sound asleep." The group is then asked to react to the story. The instructor can help by asking questions, such as:

- Does this story sound familiar?
- How do you think the story continues?
- What would you do if you were the driver?
- What would you do if you were the passenger?
- What if it was raining on top of it all?
- etc.

Another and a more elaborate variant of the above method is to use role-playing, like in the following exercise:



The scenario, e.g. “three boys on a trip to the discotheque in the driver’s newly-bought second-hand 1978 BMW” is improvised by three of the learners while the rest of the group is watching. The two passengers are instructed beforehand to try to influence the driver in some way. After a few minutes of dialogue, the group can intervene and turn events into another direction to see how the story unfolds. For example, the driver can try to keep his head and not budge to pressure.

The aim of this type of exercises is to make participants reflect upon their behaviour and risk-taking in relation to the traffic context. It is important to finish off with a follow-up session during which the learners should be able to ventilate the emotions that the role-play may have brought to surface. The instructor can ask questions such as:

- How did it feel to be pressed like that?
- Has anyone experienced something similar in reality?
- What do you think the driver could have done?
- etc.

The instructor can also comment on what the group just witnessed, and point towards solutions the group did not think of.

The latter of the examples above could very well have been included under the next heading, self-evaluation. Although level 3 is connected to driving and level 4 to life outside the traffic environment, it is perhaps unnecessary to try to differentiate too much between them when it comes to practical teaching and learning methods. The same repertoire of methods can most favourably be applied to both.

## **Self-evaluation**

The various factors connected with the goals of the trip, and especially with the context of driving, are complicated topics, and require educational methods that increases a person's subjective awareness of strengths and weaknesses regarding personal planning skills and habits. The learner obviously has little experience of planning driving trips, and this topic is therefore suitable to be included during the latter part of training, when both the learner and the instructor have had an opportunity to see actual performance in this respect.

If the driver is aware of typical personal goals for driving or habits when encountering problematic situations, or social pressure, he or she could be better prepared to meet these problems. For example, if a driver who tends to react to time-pressure with aggression is aware of this tendency, he or she could plan trips better. Or mere knowledge or awareness of this tendency might help reduce its effects. Likewise, a youngster that is acting as the driver for a group of drunken friends, could already beforehand be mentally prepared for rejecting peer suggestions that might be hazardous.

Self-evaluation provides an opportunity to give the learner a realistic picture of his or her personal motives for why he or she is driving and in what contexts. There is in this sense a close connection between driving during a trip and general life goals, motives and behaviour on level 4, the highest level. The hierarchical perspective emphasises that trips are planned according to the driver's general tendencies and goals. These are matters that only the learner knows.

Topics that should be address include how the learner's own motives for travelling mode (company, mood, driving state, time of day etc.) influence the outcome of the trip, especially from a safety point of view. Handling pressure is another topic, e.g. a discussion on the options in such a situation?

As mentioned at the beginning of this chapter, the structures on level 3, and level 4 for that matter, must often be addressed indirectly, e.g. so that they are influence through the lower behavioural levels. One method is outlined below (adapted from Advanced, 2002):

A track exercise comprising from start to finish:

- A starting line.
- Slalom driving around cones.
- Front way and reverse parking.
- Driving through a narrow passageway (between two rows of traffic cones).
- Driving a 100 m stretch.
- A finish line symbolised by a traffic cone at which the car has to be stopped.

The participants are instructed to complete the different parts of the exercise as quickly as possible as they will be timed. Although the goal of the exercise is thus stated to relate to speed, the actual goal is to make the participants aware of how difficult it is to drive under pressure. This pressure is manifested in many forms:

- Just before start, the instructor encourages the driver to increase the volume of the car radio, and
- asks the driver a complicated technical question, which he or she must think about while driving and find the answer to before arriving at the finish line.
- The driver begins with the slalom or the parking, and is told that he or she will be penalised for every fault. This generally involves knocking over traffic cones.
- The other participants are watching (beside the track, or in the car as passengers). This generally evokes peer pressure and to the desire to complete the exercise in a respectable time compared to other drivers in the group.
- Timing of the performance leads to a belief that there will be some kind of ranking afterwards.

In fact, there is no ranking, and the penalties are noted but never added up. Group discussion and feedback afterwards is designed to reveal the difficulty individuals had in coping with all the pressure. Links can preferably be made with similar pressure in real-life driving situations. Most of the pressure relates to level 3 risk-increasing factors, but also to level 4 (provided the person is able to recognise his or her own behaviour in the exercise and discussions).

Self-evaluation is also the starting point when making connections between certain behaviour and its wider consequences, or chains of consequences, for example:

The group may discuss what might happen when being in a hurry. Being in a hurry usually leads to speed, which in turn leads to frustration. Frustration lowers the tolerance threshold for obstacles and often leads to non-fluent "pushy" driving. This in turn affects and irritates other road users.

The above example may also serve to illustrate the connections between decisions on level 3 and the demands that are put on skills on levels 2 and 1. Good planning lessens the workload on the other levels, e.g. the demands put on car handling skills.

### Level 4: Goals for life and skills for living

Hierarchical level of behaviour (extent of generalisation):	Central content of driver education:		
	Knowledge and skills the driver has to master	Risk increasing factors the driver must be aware of	Self-evaluation
Goals for life and skills for living (global)	Knowledge about / control over how general life goals and values, behavioural style, group norms etc. affect driving.	Knowledge about / control over risks connected with life goals and values, behavioural style, social pressure, substance abuse etc.	Awareness of personal tendencies re. impulse control, motives, lifestyle, values, etc. Developing self-evaluation skills.

Whereas level 3 is connected to a specific journey, level 4, the highest level in the hierarchy, is to some extent disconnected from traffic as such as it contains the preconditions that ultimately shape a person's life in a global sense. Traffic is only one part of this total.

The hierarchical view stresses the importance of personal motives, tendencies and social relations of a driver in a broader sense. These not only include personality factors such as self-control, but also life-style, social background, gender, age, group affiliation and other preconditions that have an influence on attitudes, motives, choices and behaviour as a driver.

Complete understanding of behaviour (e.g. fast acceleration) is impossible without understanding the goal or motivating factors (e.g. time pressure or wish to demonstrate the car's performance). Furthermore, modification of inappropriate behaviour is not possible without modification, or at least, awareness of personal goals. Mere awareness of the behaviour itself is according to the hierarchical view not possible in that the motives that dictate the behaviour has overriding authority. As far as driver training is concerned, we therefore need to emphasise methods that are capable of dealing with motivational and other factors connected more widely with drivers' strategies, motives and skills for life. The clientele in driver education consists mostly of youngsters who are in some respects still in the midst of an identity-creating process. The task of driver education becomes therefore partly one of arranging

support for young persons in this development so that they could mature in a more safe way. Even though it cannot be expected that driver education can radically change a young person's life goals, it should make that person conscious of such personal tendencies that affect driving behaviour.

The highest level in the hierarchy (or level 3 for that matter) is not accessible through teacher-centred methods like lecturing. Active learning methods are needed, which make use of the learner's own experiences.

## **Knowledge and skills**

The first column on level 4 focuses on general life factors that affect driving. Issues to be covered include:

- Personality.
- Emotions.
- Motives.
- Life style, habits.
- Social preconditions and group affiliation.
- Age and sex vs. driving.
- Importance of cars and driving in relation to life goals.
- Choice of transport mode (as on level 3: when, where, how and why).
- etc.

In driver training the idea on level 4 (and to some extent also on level 3), would be to show the driver that driving is a form of behaviour, in which success or failure are closely related to motivational characteristics and chosen strategy. Any change in e.g. behaviour, motives, or knowledge on this level brings about change at other levels too.

## **Risk increasing factors**

The second column refers to risk increasing aspects of motives, lifestyle and personality:

- Values, habits and attitudes towards life and society.
- Risk and sensation seeking.
- Impulse control.
- Competitiveness.
- Attitudes towards the use of alcohol or drugs in general.
- Self-enhancement through driving (importance of cars for self-esteem).
- Compliance with social pressure.
- Overconfidence / under-confidence.
- Poor attention levels / absentmindedness.
- Sub-standard eyesight or other physical/mental handicaps.
- Imitation of idols (boosting self-esteem).
- etc.

Taking impulse control as an example, its relevance for driving is easy to see: Good impulse control leads to less hasty decisions, which in turn promote calmness in driving on the whole. Competitiveness is another good example: The more this feature is present in a person's life, the more probable it is that traffic becomes one arena in which it can be played out.

Role-plays and discussions are the main methods to be used. For example, the group can discuss the role of the car as a means to boost one's self-esteem. A role-play can then be performed in the same way as was described above when dealing with level 3, not forgetting the discussion afterwards.

### **Self-evaluation**

Self-evaluation on this highest level is a matter of increasing awareness of things that are normally not open for scrutiny, i.e. one's habits, way of behaving, attitudes, motives for behaviour, etc.

Learners should understand how e.g. group pressure develops and how it influences him or her personally. They should realise that their goals and motives of life outside the traffic environment influence their behaviour in traffic, too. Another aim is to connect what has been learned in relation to the three other levels to the content of this fourth level

Level 4 issues can also be addressed e.g. after an exercise on the track, in which case the exercise serves as a trigger for discussion and analysis (cf. example in conjunction with level 3 above). Role-play exercises can be used as a kind of safe way for learners to try out alternative ways of behaving or relating to things. In the same way, such exercises work as mirrors in that we may see our own behaviour reflected in the behaviour of others. Promising results have been gained in Finland through interventions that demand personal effort in the form of active participation and discussion. On one instance (Koivisto, 1997), a "mirroring" technique was used:

A safety campaign was launched with the aim to influence the traffic behaviour of drivers through helping them to recognise personal strengths and weaknesses. To begin with, the actual traffic behaviour of the target group was recorded. This "message" was then mirrored back and formed the issue upon which a subsequent discussion was based. Measured later, both behaviour and attitudes of the target group were positively affected.

Similar techniques as in the example could be employed also in driver education. One variation might be to let learner's answer questions in writing, maybe at home before coming to the first driving school lesson. The questions could concentrate on broad topics such as why they want a driver's licence, and similar.

Instructors need not be worried about finding topics for discussion, and everyone should have an opinion e.g. in the following exercise:

The group is first divided in half. One half then settles down to find as many arguments as possible in favour of e.g. the following topic, and the other half against:

"Powerful cars make an impression on girls!"

The topic is then debated.

Another example: In Finland, a simple computer-based traffic interaction test is being used that produces a kind of profile of the interaction style of the person taking the test. In the test, a number of typical traffic situations are presented that require a solution. From among a set of ready-made solutions, the learner then has to select one that he or she finds appropriate and corresponds to his or her own typical way of dealing with such situations. The computer finally provides an overview of the learner's style of interacting with others.

This type of social profile-making is perhaps not suitable as a topic for group discussions, but might provide a basis for self-reflection, and a basis for discussions in the car when the learner and instructor are driving together.

As the examples highlight, the key to the highest level in the hierarchy and to an increase in self-evaluative skills lies in the activity of the learner him-/herself. The recent trends in pedagogic theories emphasise problem-based learning and experiential learning, i.e. learning evolves through making active use of personal experiences. And, when dealing with topics such as the ones on level 4, only the learner him-/herself has the key to unlock them.

## **CONCLUSIONS**

The main messages throughout this work have been, firstly, that driving skill may be conceptualised as a broad set of skills that are used according to drivers' goals and motives, and secondly, from this arise a need for versatile use of pedagogic methods. No single theory or method can alone be expected to cover all levels of the hierarchy of driving behaviour, even though certain features of training may do so. The goals of training and the level that is being focused on should determine the optimal learning method.

The key to the higher levels in the hierarchy and to an increase in self-evaluative skills lies in the activity of the learner him-/herself. The recent trends in pedagogic theories emphasise a constructivistic approach to learning, problem-based learning and experiential learning, i.e. learning evolves through the learner's own activity, making active use of personal experiences.

Fairly simple training methods, traditional lecturing, repetition and memorising (e.g. traffic rules or traffic signs) probably produce rather good results as long as we move around the lower parts in the framework. However, these methods can be improved by good feedback, e.g. connecting a certain traffic rule to the wider context by discussing its role for safety. Letting the learners know the goals of a lecture or of an exercise may also contribute to the motivation to learn, and thereby to level of understanding. Appropriate timing of lectures and exercises should be emphasised: different aspects of training should follow in logical order and support each other.

What has been outlined on these pages may be summarised by concluding that the following aspects should, in light of the hierarchical approach, and the GDE-framework be borne in mind in driver education:

- Skill training should be balanced with risk-awareness exercises.
- Teaching skills, acknowledging the risks involved in these skills, and self-evaluation on the personal aspects of these skills and risks, should alternate and complement each other
- The curriculum as well as the training should cover all four levels in the hierarchy. Otherwise the view of the driver's task is not complete, which affects learning goals and the learning exercise, both during training and afterwards.
- Driver training should promote the view of driver behaviour as a self-paced, multi-level task.
- The training process should start with gaining a certain necessary level of automatism in vehicle manoeuvring (the first level) before proceeding to mastering traffic situations (the second level).
- Even though vehicle manoeuvring skills and skills for mastery of traffic situations are the basis for success in traffic, these skills should be connected to the higher levels and trained in such a way as to avoid any negative effects.
- Increasing the amount of training in manoeuvring and mastery of traffic situations without connecting it to the higher levels in the hierarchy may lead to negative safety.
- The driver's task is not only a complex psychomotor challenge requiring lower level psychomotor skills and abilities, but also an operation (safe or unsafe) that is related to the driver's goals, motivation and strategic planning, as well as skills in self-control.
- The highest levels in the hierarchy are not accessible through teacher-centred methods like lecturing or simply by increasing the amount of training. Active learning methods are needed, making use of the learner's own experiences.
- Training of self-evaluative and metacognitive skills should be included. This provides an opportunity for developing expertise after training, and for attaining and modifying motives and goals on the highest levels of the hierarchy.

The main message of the GDE-framework is that in addition to the training of basic skills, driver training should also address a driver's motives and goals related to different aspects of driving, e. g. skills for dealing with social pressures during a trip. Skills for vehicle manoeuvring and mastery of traffic situations are basic requirements for successful operation in traffic. But if the connection between these skills and the motivation to use them is not made, the effect of education may be opposite to that desired. If the motivational level fails to produce a safe strategy for driving, no level of skills in mastering traffic situations or vehicle handling is high enough to compensate for this lack of safety orientation.

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