ACCIDENT INVOLVEMENT OF YOUNG PEOPLE AND THEIR TRAFFIC SAFETY ATTITUDES

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ABSTRACT

This paper describes the results of an in-depth study among pupils in secondary school age to investigate their attitudes related to traffic safety. The study was initiated in the context of a policy to further guide the development of traffic safety education. Youngsters' attitudes were measured in seven domains, such as risk perception and risk taking, alcohol and drugs, propensity to group conformity and traffic safety related norms and values such as indifference in behaving unsafely. A further feature of the study was the measurement of pupils’ actual accident involvement. This provided empirical evidence for the relevance of attitudes to accident involvement. This knowledge provides guidance to the search for the most effective orientation of traffic safety education. The Dutch Ministries of Education and Transport initiated the study.

The study is based on a sample of 1,680 pupils in the Netherlands. The bike is their dominant way of transport. Forty percent of them face four or more risky traffic situations to/from school every day. Young people are a high-risk group in terms of accidents. It could be shown that specific attitudes correlate strongly to actual accident involvement. No evidence was found for any correlation between pupils' knowledge of traffic rules and accident involvement. Within the set of attitudes, the most predictive ones are the propensity to follow group norms and the propensity to behave decently in traffic. Other important attitude domains are the attitude towards cycling when having drunk and the degree in which youngsters tend to accept risk in traffic. Attitudes worsen as children get older. The study confirms that measures in terms of infrastructure are insufficient to prevent accidents. Education is a necessary supplement.

1. AIM OF THE STUDY

Young people are a high-risk group in terms of accidents of cyclists. The bike is their dominant way of transport in secondary school age. Unsafe behaviour is considered a major reason of accident involvement. It was considered useful to identify factors that lie behind those differences in traffic behaviour of young people. As far as those factors can be influenced by education, safety education would have a strong lead. This need led to a nation-wide study among 12-16 years-old pupils in secondary education. The study was initiated and supervised by the Dutch Ministry of Education and the Ministry of Transport.

The aim of the study was to get an overview on the state of affairs among young people with respect to knowledge, attitudes and action tendencies related to traffic safety. To this end, a test instrument was developed. The study was consciously given a comprehensive approach, addressing pupils' attitudes and action tendencies as well as their knowledge of traffic related aspects. These aspects covered a wide range of traffic safety related domains. This would allow conclusions on useful accents in safety education that is usually dominated by its cognitive orientation focusing on knowledge of road signs and traffic rules.
The research team added an extra element to the study by measuring the accident involvement of the youngsters. As far as evidence would indicate that specific attitudes correlate rather strongly with accident involvement, traffic safety education would find a lead for further development. If these specific attitudes can be influenced, traffic safety education has an even stronger case.

The thorough measurement of attitudes is typical for the study (Woldringh and Katteler, 2002). As such, it fits with other studies that focused on attitudes towards traffic safety related aspects. Studies focused usually on safety measures, such as seat belt usage or speed limits, or on enforcement of traffic regulations or traffic safety related behaviour, particularly the use of alcohol (e.g. SARTRE, 1998; Cauzard and Quimby, 2000). Other studies focused on specific groups such as young drivers and, more specifically, the attitudes of novice drivers (e.g. Laapotti et al., 2002). The study discussed in this paper, is different from those studies given the broad scope (coverage of both knowledge and attitudes; coverage of several safety related domains) and the correlation with accident involvement that was sought.

Sections 2 and 3 include methodological issues. Section 4 gives selected results of the test. Section 5 describes how accident involvement was measured and in what degree knowledge and attitudes are correlated to accident involvement.

2. MEASUREMENT OF ATTITUDES

Selection of domains

The objective to attain a broad overview of the state of affairs regarding young peoples’ traffic related knowledge, understanding and attitudes raised preliminary questions to the research team: knowledge of what? Attitudes towards what exactly? The starting-point was the choice to cover a broad spectrum of domains and to include all possibly relevant domains. This choice for a comprehensive model required an overview of those domains that could be considered relevant to traffic behaviour. This overview could be put together on the basis of expert views on domains that should be learning objectives in education. Eleven experts had commonly identified ten objects/domains as elementary conditions to safe traffic behaviour. Within each domain, sub-domains in terms of knowledge aspects, attitudes and cognitive skills were identified. In total, the experts identified over 20 sub-domains as learning objectives in safety education (Twisk, 1999). The research team considered the number of 10 main domains as too high and removed domains that had a relatively low degree of relevance to traffic safety or where the relation to traffic safety was considered too indirect (such as mode choice). The preparatory work resulted in the selection of seven domains that would be covered by the test. These traffic safety related domains are the following:

1. Traffic rules;
2. Ability to identify risky situations (risk identification);
3. Ability to put oneself in someone else’s position in traffic (changing of perspective);
4. Alcohol and drugs in relation to traffic;
5. Dealing with group pressure; lead behaviour;
6. Safe use of the bike; injury protection (physical aspects);
7. Traffic behaviour related norms and values.
Selection of concepts

The choice for a comprehensive approach also included different measurement levels such as knowledge and attitudes. In fact, the preparatory stage of the study focused, among others, on the question towards which levels the test should be oriented. Experts distinguished between knowledge and cognitive skills. Although this distinction is valid, hardly any differences could be made in the later stage in which operational definitions of the constructs were made. Therefore, it was decided to combine knowledge and cognitive skills into one level. As far as the attitude level was concerned, the study team decided to distinguish between an emotional component on the one hand and action tendencies on the other, according to the socio-psychological tradition with respect to attitudes. As a consequence, a set of three levels (knowledge in a broad sense; emotion and action tendency) was realised. Subsequently, the test instrument can be said to have a broad orientation, both in terms of covered domains and levels within each domain.

Seven domains and three levels theoretically make for 21 sub-domains. A few sub-domains could be ignored, as these sub-domains were not relevant (e.g. knowledge of group pressure). Eighteen sub-domains remained as relevant areas to cover. Since several sub-domains were thought to include more than one relevant concept, the total number of concepts to measure became even larger. For example, the following three variables were identified in the sub-domain ‘norms and values at the attitude level’:

- Appreciation of traffic safety (to what extent do young people attach value to behaving safely or to using the road in a safety context?);
- Attitude towards incorrect traffic behaviour of the pupil himself/herself (does the pupil feel indifferently or is the pupil sensitive to own faults?);
- Attitude towards incorrect traffic behaviour of others.

Also three concepts were distinguished in the sub-domain ‘knowledge of traffic rules’:

- Knowledge of traffic rules and traffic signs;
- Knowledge of the informal basic rule of behaving in traffic (not to bring yourself or others in danger);
- Ability to apply rules.

Table 1 shows the 7 domains, 3 levels and 25 concepts that were covered by the test instrument. Horizontal reading gives the concepts used per domain whereas e.g. all attitude variables are given when reading vertically.

Each of the 25 concepts required to be laid down into measurable terms. The development of the test had to take into account the following set of conditions.

- Target group consists of 12-16 years-old pupils;
- The test should be applicable and understandable for pupils in all types of education, varying from special education to all types of secondary education.
- The test should allow pupils to answer individually;
- The length of the test should not exceed one lesson of 45 minutes.

In addition to these requirements, it was considered necessary to realise variation in the presentation of the items in order to keep the pupil’s attention. This was realised by offering photographs and illustrated traffic situations. However, the majority of the domains were addressed by item sets (Likert scales). The primary challenge was developing a test that is applicable for pupils of any intellectual level and, at the same time, discriminating young people with different safety related knowledge and attitudes.
Table 1. Domains and concepts covered by the test

<table>
<thead>
<tr>
<th>Level</th>
<th>Domain</th>
<th>Knowledge</th>
<th>Attitude</th>
<th>Action tendency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traffic rules</td>
<td>Knowledge of traffic rules and traffic signs;</td>
<td>Importance attached to rules/signs</td>
<td>Non-conformity (self-profile)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Knowledge of informal basic traffic rule</td>
<td>Attitude towards non-conformity</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ability to apply rules</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Risk identification</td>
<td>Distinguishing ability in recognising risks</td>
<td>Sensitivity to risk</td>
<td>Risk acceptance</td>
</tr>
<tr>
<td></td>
<td>Change of perspective</td>
<td>Understanding of blind spot</td>
<td>Feeling when hindering</td>
<td>Consideration for (vulnerable) road users</td>
</tr>
<tr>
<td></td>
<td>Alcohol, drugs</td>
<td>Blood alcohol level permitted</td>
<td>Towards people who drive with alcohol</td>
<td>Using alcohol when using the bike</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consequences of use of alcohol/drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dealing with group pressure</td>
<td>Factors that affect vehicle’s braking distance</td>
<td>Propensity to group conformity</td>
<td>Degree of peer behaviour</td>
</tr>
<tr>
<td></td>
<td>Physical aspects</td>
<td></td>
<td>Use of safety increasing attributes(^1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Norms and values</td>
<td></td>
<td>Towards pupil’s own incorrect behaviour;</td>
<td>Propensity to decent traffic behaviour</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Towards others’ incorrect behaviour;</td>
<td>Self-profile</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Appreciation of traffic safety</td>
<td></td>
</tr>
</tbody>
</table>

1. E.g., the willingness to be clearly visible

Defining indicators of one particular concept caused insurmountable difficulties, namely the ability in distinguishing risky situations from less risky situations. In trying to present photographs with different degrees of safety risks, it had to be concluded that even experts could not reach agreement on which situations could be considered risky and which situations not really risky. This distinction was sought in order to have an inter-subjective common view against which the individual assessments of pupils could be judged. As a consequence, the concept ‘ability in recognising risky situations’ could not be used. Ultimately, youngsters’ reactions on 2 photographs and 7 statements (‘the presented situation is hardly/ a little/ very risky’) were used to infer a measure of risk sensitivity.

Most concepts were measured using scale construction. This required a set of items per concept. Special attention was given to requirements of reliability and validity. The scale reliability could technically be tested (see section 3). In the stage of development of the test, the validity of individual items and photographs was checked in terms of face validity using the judgement of experts. They judged on the degree in which the operational definitions
could be considered a realistic and valid representation of the concept in question. In a later stage of the project, the validity could be checked against some logically expected correlations, such as the higher level of knowledge of pupils of 14-15 years old versus pupils of 12-13 years-old.

3. THE RESEARCH PROCESS

Test development

Three main development stages preceded the nation-wide use of the test among secondary school pupils. The stages were:

Stage 1: The construction of operational definitions;
Stage 2: Testing of the instrument;
Stage 3: Checking for the scalability of the item sets.

All chosen concepts within the seven domains were defined in operational terms in the first stage. When possible, previously used operational definitions that already approved to be reliable, were selected. However, this could only be done in a minority of the concepts. The test mainly consisted of a mixture of questions and statements, some of which were visualised with photographs and schematically presented traffic situations. The measurement of action tendencies inevitably had a self-report nature. Experiences elsewhere did not discourage this strategy (Hatakka et al., 1997).

Pre-tests were conducted to check the comprehensibility and the practicability of the diverse components of the instrument. The items needed to be understandable for pupils of the lowest classes in special education. Therefore, a first pre-test focused on pupils in special education. This resulted in the inclusion of very basic traffic situations, enabling the research team to measure knowledge of elementary traffic rules. A second pre-test was held among 43 pupils in different types of education. Pupils were asked to indicate the degree of complexity of each block of questions. The contents of parts of the test were individually discussed with the test leader. This gave the information, among others, that the use of popular slang was not appreciated. For example, the statement ‘someone who ... is a sissy’ was removed for that reason. Further point of attention was the test duration. Although the majority of the pupils could complete the test within the lesson of 45 minutes, one-third of the pupils could not. Therefore, the number of items had to be reduced.

A third pre-test was held among 234 pupils in 12 classes within six schools. Obviously, comprehensibility and practicability received substantial attention. Further reduction of the number of items appeared necessary. The selection of items that should be removed was guided by the level of difficulty of the item and by the items’ behaviour in terms of scalability. Scalability tests were a major objective of this pre-test stage. The pre-test revealed that reliable scales for the majority of the concepts could be constructed.

The preparatory work resulted in a test instrument, consisting of 110 questions or items that defined the 25 concepts across the seven domains at the knowledge, the attitude and the action tendency level. Additionally, the test instrument included indicators of the home-school route, in particular the type of obstacles encountered every day (such as roundabouts and ungated railway crossings) and the number of obscure crossings. This allowed comparing the relative importance of knowledge, attitudes and infrastructure related risk exposure to accident involvement.
Nation-wide measurement

A sample of schools in The Netherlands was selected taking into account the distribution of schools across regions and the number of pupils in different types of education. Within each school, three classes were selected spread across the school years 1, 2 and 3 (pupils of 12-15/16 years-old). A total number of 26 schools participated in the test. Fourteen of the schools were secondary schools oriented towards vocational education (‘vmbo’). This followed the fact that about 55% of all pupils in secondary education in the Netherlands receive basic vocational education. Pupils in the 3rd school year and pupils in ‘vmbo’ were underrepresented in the realised sample. As far as the realised sample did not match the distribution of the total population of pupils, data were weighted.

The study comprised a sample of 1,681 young people aged 12 - 16 years, selected in the stratified sample of all types of schools and school years. The pupils completed the comprehensive self-administered questionnaire in class answering on statements, illustrations and photographs. Almost half of the respondents (45%) belonged to the age category of 12 -13 years old. The other half was 14-15 years old with a small group in the age category of 16 years. Most pupils in the sample usually come to school by bike (89%). The sample could well distinguish between cyclists who face complex crossings daily and those who do not.

Scale construction

Most concepts were indicated by a set of items. Factor analysis checked whether each set of items represented one underlying concept. A scalability test was carried out for all item sets that were available for scale construction. Cronbach's alpha was used to indicate the reliability of each scale. A minimum value of .65 for attitude scales was required to continue the process of scale construction. Scales could be constructed for each of the seven domains.

The average score on the scale items determined pupils’ position on each scale. Scale classes were defined independently of the frequency scores. Since the study objective was to get an overview of the state of affairs of knowledge and attitudes, well interpretable and ‘objective’ class positions were preferred. Each scale received five positions, ranging from very low to very high (knowledge level) or from very negative to very positive (attitudes). This procedure allowed conclusions of the type: ‘x percent of the pupils show a strong tendency to accept risk in their traffic behaviour’ or ‘y percent of the pupils have a positive attitude with regard to their own drinking behaviour when faced with travel’.

The question remains whether or not the knowledge level or attitude level of young people can be considered positive enough. Should 70% of the sample be positive to decide that the population of pupils has an acceptable level? Will 60% do? Or should traffic education aim at 80% or even higher? The subject of setting standards was discussed on the basis of the study results. Two types of standards were advocated and used. An empirical standard was identified on the basis of the scores of those pupils who had no accident involvement. This inevitably included a different standard per concept. A normative standard was set, claiming 80% of the youngsters should be positive in whatever respect, taking into account that the current level of accident involvement is too high. The subject of setting standards goes beyond the scope of this paper.
4. KNOWLEDGE AND ATTITUDES: SELECTED RESULTS

This section presents results on young people’s knowledge and attitudes. Obtaining this type of result was the major goal of the study. Because this paper’s objective is to demonstrate the relation of knowledge/attitudes and accident involvement, rather than to focus on the state of affairs in terms of knowledge and attitudes of young people, only a limited selection of results will be given.

Young people’s knowledge

In fact, measurement of pupils’ knowledge of traffic rules and traffic signs was part of the test, realising that knowledge is essential for safe participation in traffic, but not an evident predictor of safe behaviour. Safety education without attention given to traffic rules is hardly conceivable. The test instrument wanted to establish whether or not the 12-15 years-old age category has mastered basic rules. The test items indicated real basic knowledge level by presenting elementary right-of-way situations. Eight of the ten illustrated pictures contained only two road users of which always one bike-rider. Each road user should be able to answer these correctly.

Although a high proportion of pupils could be expected to master the right-of-way rules, the outcome can be considered disappointing. One-third of the pupils achieved poorly with a maximum of 6 correctly interpreted traffic situations. Combined with an additional 20 percent of the pupils that missed three questions, half of the young people cannot be said to have mastered basic right-of-way rules that are recurrent every day. Interestingly to observe, incorrect answers include a tendency to overcautious behaviour. ‘Stronger’ road users are given way more frequently than vice versa. This tendency partly explains that poor knowledge does not correlate to accident involvement (see section 5).

Boys and girls as well as age groups show similarities in terms of basic knowledge of priority rules. A remarkable difference was observed between knowledge level and type of school. Pupils on vocational training oriented schools (‘vmbo’) show a lower level of knowledge than pupils on secondary schools with highest level of education (see Figure 1). It can be seen that basic knowledge is different per school year within the vmbo-type of schools. This ultimately results in a large knowledge gap between pupils of a pre-vocational level in year 1 (30% of pupils mastered basic rules) and pupils in general secondary education in year 3 (60%).

Figure 1. Knowledge level of basic rules per school year and school type
Young people’s attitudes and action tendencies

A diversity of attitudes and action tendencies related to traffic and traffic safety were measured. Although the concepts might be overlapping to some extent, each of the concepts emphasise a special area of traffic safety behaviour such as being considerate to other road users (e.g. older people), showing consideration for incorrect behaviour of others and propensities such as non-conformity to traffic rules, following group behaviour or using alcohol when participating in traffic.

The sample of young people did not score equally across the various attitudes. Although many of the attitude scales correlate positively to each other, the scales appear to cover different aspects of the traffic behaviour spectrum. A large part of the sample had negative scores with respect to four attitudes and action tendencies. These concepts are:

- Attitude towards pupil’s own unsafe behaviour. This scale was based on 6 items.
- Propensity to behave decently. Five items were used, e.g. pupil’s reaction when approaching a pedestrian crossing where a pedestrian hints that he will cross over, or how a pupil reacts when he is about to be knocked down by a car but is saved by an emergency brake of the car.
- Attitude towards group following behaviour (4 items).
- Action tendency in terms of the use of safety increasing attributes such as willingness to be clearly visible after dark (4 items).

The attitude of the sample population to their own unsafe behaviour is shown here as an illustration. Six items were used, including: ‘After I have done something really dangerous in traffic, I do not feel ashamed about it’ and ‘If you have to chose between a pleasant, but less safe route or a safe, but less pleasant route, which one do you normally chose?’ Boys showed a slightly more negative attitude in this respect than girls. This tendency was consistent across almost all attitudes and concepts: girls generally have better attitudes than boys. Different accents in attitude towards own unsafe behaviour were found between pupils in distinct school years (see Table 2). Differences between youngsters in rural areas and youngsters in cities could not be found.

Table 2. Pupils’ attitude towards own unsafe or safe behaviour

<table>
<thead>
<tr>
<th></th>
<th>All pupils</th>
<th>Boys</th>
<th>Girls</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative/indifferent</td>
<td>34%</td>
<td>39%</td>
<td>26%</td>
<td>27%</td>
<td>33%</td>
<td>42%</td>
</tr>
<tr>
<td>neutral</td>
<td>29%</td>
<td>28%</td>
<td>29%</td>
<td>24%</td>
<td>32%</td>
<td>30%</td>
</tr>
<tr>
<td>positive/feeling guilty</td>
<td>37%</td>
<td>33%</td>
<td>45%</td>
<td>49%</td>
<td>35%</td>
<td>28%</td>
</tr>
<tr>
<td>Total (100%)</td>
<td>(1681)</td>
<td>(912)</td>
<td>(758)</td>
<td>(629)</td>
<td>(592)</td>
<td>(460)</td>
</tr>
</tbody>
</table>

1. In terms of ‘does not feel ashamed when other road user falls due to pupil’s unsafe behaviour’, or: pupil prefers unsafe but pleasant trajectory over safe but less pleasant trajectory, etcetera.

In contrast to those four scales on which rather many young people scored negatively, other attitudes showed more positive results. One of these concepts was the propensity to risky behaviour. Two-thirds of the pupils in the sample claimed to never or, at the most, sometimes take risks. The remaining one-third admitted to take risks frequently. Although risk-taking as an action tendency has a relatively favourable position in the whole of attitudes, many young people (in absolute sense) accept a clearly increased chance of incidents or accidents due to their conscious risky behaviour on a regular basis.
A second concept that scored relatively well was the attitude towards the use of alcohol when participating in traffic. Four items were used to scale pupils on a continuum. One of the statements to answer was: ‘I think that if someone is half drunk, he can still ride a bicycle’. According to the scale based on the four items, slightly more than half of the sample can be said to have a critical, scrupulous attitude in this respect. However, attitudes worsen when children get older. A high proportion (70%) of 12 years-old pupils held a critical view on alcohol usage in relation to traffic behaviour, against 42% of 15 years-old pupils (see Figure 2).

Figure 2. Development of knowledge and attitude with respect to alcohol by age group

Two additional tendencies can be observed in Figure 2. Attitude and knowledge show opposite patterns. When children get older, their knowledge of effects of alcohol improves. However, their attitudes worsen. Since attitudes most probably influence behaviour stronger than knowledge does, this pattern can be considered a threat for safe behaviour.

As a third tendency, attitudes seem to improve when young people get 16 years old. Although the number of 16 years-old pupils in the study was limited and the change of the curve is modest, this pattern can also be found in studies concerning youthful deviant behaviour, particularly minor offences (van der Laan and Essers, 1998). This similarity suggests that attitudes with respect to safe and unsafe behaviour in traffic is an exponent of a more general pattern of deteriorating attitudes correlated to increasing age in the adolescent years. In turn, this could imply the usefulness of a broad educational approach in which safety education is embedded.

5. ACCIDENT INVOLVEMENT

Measuring accident involvement

The measurement of accident involvement was not part of the original study objectives. However, it was acknowledged that the study would gain relevancy by demonstrating correlation between young people’s accident involvement and their traffic related knowledge or attitudes. In fact, the importance of traffic safety education would be underlined when a relation is empirically established.

Accident involvement was measured on a detailed basis. The measurement took into account that accident involvement actually has levels of seriousness ranging from more severe accidents with hospitalisation to incidents with a lucky escape. Inevitably, the design was confined to self-reported accidents. Within this context, the pupils were asked to report on their involvement in three types of accidents in the last two years:
- Accidents resulting in hospitalisation or medical treatment;
- Accidents with just material damage;
- Near-accidents.

The research team was fully aware that pupils’ interpretation of situations in terms of near-accidents might differ and that retrospection might influence the results to some extent. Nevertheless, these disadvantages were considered secondary to the improved validity and the more balanced approach surpassing the practice to regard equally registered accidents or injuries and accident involvement.

Whereas the percentage of pupils with injuries in the last two years appeared to be at a ten percent level, substantial more young people faced an accident with material damage (34%). In total, 38% of the pupils were involved in accidents of a physical or material type. Almost half of these pupils were involved in accidents more than once. Apart from the involvement in accidents either with physical injuries or with material damage, half of the pupils reported that they had one or more near-accidents (also labelled as incidents here). Technically, this enabled discriminating pupils according to this dependent variable and to correlate with knowledge and attitudes. Conceptually, the high number of pupils that appear to have had accidents or near-accidents reinforces the idea that accident involvement includes a gradual phenomenon ranging from near-accidents to fatal accidents. Figure 3 shows the degree in which pupils claimed to be involved in the different types of accidents.

Figure 3. Pupils’ involvement in different accident types (N=1.681)

In total, the minority of the pupils aged 12-16 year was not involved in any accident type whereas 60% of the pupils claimed that they were involved in an accident or incident in the last two years. This accident involvement was occasional for less than half of these pupils whereas more than half of the pupils with accident experience claimed to be more regularly, some even frequently involved in (near-) accidents. On balance, 34 percent of the pupils were fairly frequently involved in (near-) accidents.

It is interesting to observe from the data that near-accidents are a first step to the occurrence of accidents. Data showed that those pupils who got injured or had material damage accidents also had relatively many near-accidents and, vice versa, most young people without near-accidents were not involved in traffic accidents.
Table 3. Relation between accidents and near-accidents (pupils 12-16 years old)

<table>
<thead>
<tr>
<th></th>
<th>Practically never</th>
<th>A couple of incidents</th>
<th>Almost every month or even every week</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real accidents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not involved in accidents</td>
<td>64%</td>
<td>27%</td>
<td>9%</td>
<td>100%</td>
</tr>
<tr>
<td>(968)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once involved</td>
<td>47%</td>
<td>35%</td>
<td>18%</td>
<td>100%</td>
</tr>
<tr>
<td>(332)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upward of twice involved</td>
<td>20%</td>
<td>46%</td>
<td>34%</td>
<td>100%</td>
</tr>
<tr>
<td>(247)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>53%</td>
<td>32%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>(1547)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Pearson correlation $r = .34$; $p < .001$

It should be noted that a part of the accidents happened through no fault of the pupil. The figures mentioned before do not take this fact into account. Since pupils also indicated whether or not the accident happened due to own or other people’s fault, data allow focussing on accidents that happened through their own fault. Accidents with material damage and near-accidents were reported to have happened as frequently through their own fault as through other people’s fault. According to the pupils to whom injuries happened, other road users caused these accidents more frequently. Data do not suggest that pupils answered on a socially desirable way.

Characteristics of the home-school trajectory were identified in terms of recurrence of risky traffic situations (such as roundabouts, obscure crossings or cycling on roads without separate bicycle markings) and the length of the trajectory. Data demonstrated that the accident involvement is clearly related to the trajectory’s infrastructure. For example, 55% of the pupils who usually encounter two or more risky traffic situations faced several near-accidents in the last two years whereas ‘only’ 37% of those who have none or only one obstacle had a near-accident. This strengthened the idea that the operational definition of the concept of accident involvement was a valid one.

**Attitudes and accident involvement**

The empirical study distinguished traffic safety related knowledge and attitudes. No evidence was found for any correlation between pupils’ knowledge of traffic rules and accident involvement. Also other knowledge concepts such as knowledge of effects of the use of alcohol or drugs in traffic did not show to be correlated to accident involvement. Better knowledge does not imply safer behaviour according to these findings.

Unlike knowledge, attitudes of young people appear to correlate rather strongly with accident involvement. Within the set of attitudes, the most predictive ones are the propensity to follow group norms and the propensity to behave decently in traffic. Both attitudes showed a Pearson-r correlation with real accidents (injuries; material damage) of $r=.17$ and a Pearson r-correlation of .30 with near-accidents. Other important attitude domains are the attitude towards riding a bike after drinking alcohol and the degree in which youngsters tend to accept risk in traffic. It also turns out that safe use of the bike (e.g. the use of a dynamo after dark and riding with proper brakes) has predictive value for accident
involvement. Generally, attitudes and action tendencies can be said to correlate to accident involvement.

Multiple regression analysis was performed in order to describe the total variance in accident involvement in the sample of pupils. Analysis showed that 6 attitude variables could explain 13 percent of the total variance (multiple correlation coefficient $r=.36$). The actual significance of these outcomes is that traffic related attitudes matter. A relatively large part of young people with negative attitudes is involved in accidents whereas young people with positive attitudes and action tendencies are less involved in accidents.

A multiple stepwise regression analysis was carried out as a final analysis including both attitudes and infrastructure variables. The best combination of variables that explain the maximum of variance in accident involvement in the sample of pupils is shown in Table 4. Six variables explain 15 percent of the total variance ($r=.39$). Two of the variables significantly contributing after selection of other variables in the model, are infrastructure related (length of trajectory; number of risky traffic situations) and four variables are attitudes or action tendencies.

Table 4. Selection of set of variables most predictive of accident involvement

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R-square</th>
<th>Increase R-square</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendency to follow group norms</td>
<td>.283</td>
<td>.080</td>
<td>.080</td>
<td>.000</td>
</tr>
<tr>
<td>+ use of safe bike attributes</td>
<td>.321</td>
<td>.103</td>
<td>.023</td>
<td>.000</td>
</tr>
<tr>
<td>+ number of risky situations on-route</td>
<td>.354</td>
<td>.125</td>
<td>.022</td>
<td>.000</td>
</tr>
<tr>
<td>+ tendency to behave decently</td>
<td>.369</td>
<td>.136</td>
<td>.011</td>
<td>.000</td>
</tr>
<tr>
<td>+ length of home-school trajectory</td>
<td>.381</td>
<td>.145</td>
<td>.009</td>
<td>.000</td>
</tr>
<tr>
<td>+ degree of risk acceptance</td>
<td>.390</td>
<td>.152</td>
<td>.007</td>
<td>.001</td>
</tr>
</tbody>
</table>

Figure 4. Predictive power of groups of variables

A final assessment was made by comparing the relevancy of attitudes to road infrastructure characteristics in terms of predictive value for accident involvement. To this end, multiple regression analysis was carried out for 3 variables (risk exposure in terms of length of school route and type of risky traffic situations on-route). Figure 4 shows that attitudes are firm predictors of accident involvement. Home-school infrastructure does influence the occurrence of accidents but to a lower extent ($r=.19$). Personal and demographic characteristics such as sex, age group, type of residential area hardly contribute to the chance to get involved in an accident.
CONCLUSIONS

The study among pupils in secondary education had a comprehensive approach covering seven traffic safety related domains and measuring knowledge, attitudes and action tendencies. Additionally, accident involvement was measured, distinguishing different types of accidents and near-accidents. The study provided empirical evidence that traffic related attitudes influence accident involvement. Young people with negative attitudes were more frequently involved in accidents than young people with positive attitudes. Two of the predictive attitudes were the tendency to follow group norms and the degree of risk acceptance. In contrast to attitudes, no empirical evidence could be found for any correlation between knowledge and accident involvement. Attitudes appeared to be firmer predictors of accident involvement than obstacles on the home-school route. Since attitudes and action tendencies lead to higher accident rates, the study results underline the relevancy of traffic safety education of young people. Safety education has even a stronger case when taking into account the compliancy of attitudes.

REFERENCES


