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Relationships amongst psychological determinants, risk behaviour, and road crashes of young adolescent pedestrians and cyclists: Implications for road safety education programmes



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ABSTRACT

Road safety education (RSE) assumes that psychological determinants predict risk behaviour, and subsequently that risky road behaviour predicts crash involvement. This study examined the validity of this assumption, by analysing these relationships in two age groups of teen cyclists and pedestrians: a younger age group (12 and 13 years old: $n = 1372$) and an older age group (14–16 years old: $n = 938$). A questionnaire was administered at school during regular class consisting of items on demographics, on risk behaviour based on the Generic Error Model System (GEMS), on psychological determinants targeted in RSE programmes, and on crash involvement and near crashes. For the younger age group, the results indicated that the risk behaviours 'errors', 'dangerous play', and 'lack of protective behaviour' predicted self-reported crashes; for the older age group only 'errors' were found to be predictive of self-reported crashes and near crashes. Path analyses confirmed that risk behaviour could be predicted from the psychological determinants, sharing respectively 44% of the variance in the younger age group and 34% in the older group. In conclusion, these results confirm the RSE assumption that psychological determinants are associated with a higher frequency of risk behaviours and that the latter are again associated with higher crash frequencies. Just as in earlier studies on adolescent risk behaviour, the GEMS based distinction between errors and violations was not confirmed, suggesting that this distinction – derived from studies on adult car drivers – may not apply to young adolescent cyclists and pedestrians.

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1. Introduction

Road injuries are a prime cause of death amongst young adolescents. Much of this burden could be reduced if interventions were effective in preventing risk behaviour amongst these youngsters. Classroom-based road safety education (RSE) is one of the most commonly used interventions. But despite its popularity, little is known about its effectiveness (Dragutinovic

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& Twisk, 2006; SUPREME, 2007; Williams, 2007). Even the validity of the implicit assumptions about the relationships between the educational objectives – that is, what the RSE programme aims to achieve on the one hand, and risk behaviour and road crashes on the other – have seldom been empirically tested. Therefore, the present study examined the relationships between psychological determinants frequently targeted by RSE, risk behaviour and crashes amongst young adolescents of 12–16 years old. Note that the ‘psychological determinants’ investigated in this paper were not derived from earlier studies or theoretical models, but were based on their implicit use in education programmes. No systematic overview of these determinants is available yet, nor do RSE programme materials explicitly provide them. To overcome this, in this study psychological determinants were obtained from professionals who were familiar with some frequently used RSE programmes. These descriptions indicated that RSE programmes for 12–13 year olds addressed one or more of the following psychological determinants: ‘knowledge of traffic rules’, ‘opinions about traffic rules’, ‘carelessness’, ‘opinions about social behaviour’, and ‘hazard awareness’. RSE programmes for 14–16 year olds addressed ‘opinions about traffic rules’, ‘attitudes on alcohol use in traffic’, ‘competencies in comparison to those of others’ and ‘feeling responsible for one’s actions’.

Concerning the description and classification of risk behaviour, several models are available of which the Generic Error Model System (GEMS) is one of the most commonly used in road safety (Reason, Manstead, Stradling, Baxter, & Campbell, 1990). GEMS provides evidence for two categories of risk behaviour – ‘errors’ and ‘violations’ – each governed by different psychological mechanisms, and each requiring different counteractive methods in RSE. Errors are unintentional deviations from safe practices and reflect inadequate skills (e.g., because of inexperience), or temporarily adverse states (e.g., because of fatigue). Violations, on the contrary, are deliberate deviations from safe practices (e.g., deliberately violating a red light), reflecting a person’s safety motivation (e.g., a trade-off between risk and time lost). A recent meta-analysis on studies using the Driver Behaviour Questionnaire (DBQ) – a GEMS-based questionnaire – confirmed that for adult car drivers both violations and errors predicted self-reported crashes, with correlations of respectively .12 and .10 (De Winter & Dodou, 2010).

GEMS has also been used in studies on adolescent road behaviour. Table 1 presents an overview of the results of the four studies, showing that: (a) the expected ‘violations’ versus ‘errors’ factor structure was not found in some studies (Elliott & Baughan, 2004; Sullman & Mann, 2009), (b) the risk behaviour factors were highly intercorrelated (Feenstra, Ruiters, Schepers, & Kok, 2011; Steg & Van Brussel, 2009), and (c) in addition to ‘errors’ and ‘violations’ three other types of risk behaviour could be distinguished: ‘dangerous play’, ‘lack of protective behaviour’, and ‘unsafe crossing’ (Elliott & Baughan, 2004; Sullman & Mann, 2009). Further, only two studies investigated the association between risk behaviour types and self-reported crashes. The study amongst a large sample of Dutch cyclists found a positive association with self-reported crashes (Feenstra et al., 2011), whereas the study amongst Dutch moped riders did not find such an association, possibly due to a smaller sample size (Steg & Van Brussel, 2009). Thus, in these studies the factor structure as well as the association with self-reported crashes differ from those found in studies on car drivers. Several explanations have been offered for these differences such as the lower power in the studies, the way the items were formulated (e.g., Steg & Van Brussel, 2009), or the specifics of the pedestrian and cyclist task (Elliott & Baughan, 2004). An additional explanation might be the large age difference. In adolescence, thinking processes and social cognitions have been found to differ from those in adulthood, and also to undergo rapid changes when adolescence progresses towards adulthood (Blakemore & Choudhury, 2006; Blakemore, Den Ouden, Choudhury, & Frith, 2007; Spear, 2013). These features also affect the perception of the rationality and

Table 1
GEMS-based surveys for non-driving adolescent road risk behaviour.

Study	Road user type (sample size)	Age	Factor structure	Explained variance (R^2) ^b	Correlations amongst factors	Relationship with self-reported crashes
Steg and Van Brussel (2009) Netherlands	Moped riders ($n = 146$)	16–25	– Errors – Violations – Lapses	32%	.39–.46	Nagelkerke $R^2 = .05$ (n.s.)
Elliott and Baughan (2004) United Kingdom	Pedestrians and cyclists ($n = 2433$)	11–16	– Dangerous play – Lack of protective behaviour – Unsafe crossing	34.6%	Not reported	Not investigated
Feenstra et al. (2011) Netherlands	Cyclists ($n = 1749$)	13–18	– Errors – Violations – Extreme violations	46%	.56–.67	$R^2 = .04$ for crashes and $R^2 = .15$ for near crashes $p < .01$
Sullman and Mann (2009) ^a New Zealand	Pedestrians and cyclists ($n = 944$)	13–18	– Dangerous play – Lack of protective behaviour – Unsafe crossing	32%	Not reported	Not investigated

^a Replication of Elliott and Baughan (2004).

^b Part of the total variance explained by the factors in the ‘Factor structure’.

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