

Road Safety Education: Directions for the future

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Abstract: Road safety education (RSE) is viewed as an integral component of any road safety strategy for improving the safety of young road users. Indeed, the OECD has identified school-based RSE programs as a priority for reducing the risks of injury or death amongst young road users. A range of RSE approaches have been employed to address safety concerns for young road users, however, due to a lack of evaluation there is little evidence for or against the effectiveness of these programs. In order to ascertain the current state and effectiveness of school-based RSE programs a review of Australian and international RSE programs from the last decade was undertaken. This review revealed a number of limitations in current approaches, perhaps the most concerning among these being that many school-based RSE programs are not evidence based. Addressing these issues and other limitations in the way programs are provided may improve existing RSE programs. This paper provides some future direction for school based RSE by identifying areas for improvement in existing approaches and identifying areas for further research to ensure the continued evolution of school-based RSE.

Introduction

Road safety education (RSE) is viewed as a means for improving the safety of young road users in a number of areas ranging from pedestrian and bicycle safety for young children to safe driving for adolescents. An increasing priority placed on the provision of RSE in schools has led to the proliferation of educational programs. Organisations with an interest in road safety are continually seeking new and innovative ways to improve road safety knowledge and promote safe, responsible road use. To this end a variety of approaches and methods are employed to target different aspects of the road safety problem.

Given the diversity within the field of RSE it is important to identify the potential benefits for any given program. In order to achieve this it is necessary to have some indication of the educational requirements necessary to produce safer road users. The Goals for Driver Education (GDE; OECD, 2006) matrix (see Figure 1) provides an hierarchical organisation of the individual facets of the driving task and identifies the key education goals necessary to address these. While the matrix was originally developed to describe the educational requirements for novice drivers it has some applicability to RSE for road users of all ages. It incorporates low-order tasks (e.g., practical skills), which are also applicable to young road users (e.g., pedestrians and cyclists), and higher-order skills (e.g., attitudes, cognitions, etc.) that are important for older road users. While practical training and experiences are necessary to meet low-order skills, the production of a truly safe road user requires educational experiences that target high-order skills.

In order to gain an understanding of the efficacy of current approaches to school-based RSE a literature review of Australian and international programs was undertaken. Programs included in the study were limited to those that were provided

to school students of all ages, were in operation between 1999-2010, and addressed road safety issues relevant for school students, including driver, passenger, pedestrian, and cyclist issues. An effort was made to include programs that had been the subject of evaluation however, where reviews were lacking, evidence from analogous research was sought (e.g., evidence regarding presenter credibility, etc.). The review did not include general media campaigns or programs provided independently of schools. Programs and research meeting these criteria were identified through searches of academic databases covering topics including psychology (e.g., PsycINFO), education (e.g., Education Research Complete), road transport (e.g., ATRI), and multi-disciplinary databases (e.g., Academic Search Premier and Informit). Additional materials including reports and conference papers were identified by searching the websites of leading international and Australian road safety organisations, and government and non-government agencies throughout Australia and internationally. Keywords used to identify research included: road safety, education, road user education, road safety education, school, evaluation, effectiveness, evidence, and training. Further searches were undertaken targeting the names of programs that were identified. A comprehensive list of programs included in the review is available in Raftery and Wundersitz (2011).

Figure 1
The GDE Matrix (OECD, 2006)

	Knowledge and Skill	Risk Increasing Aspects	Self-Assessment
Goals for Life and Skills for Living	Understanding the importance of lifestyle, age group, culture, social circumstances, etc.	Understanding the importance of sensation-seeking, risk acceptance, group norms, peer pressure, etc.	Understanding the importance of introspection, competence, personal preconditions for safe driving, impulse control, etc.
Goals for, and Context of Driving	Understanding the importance of modal choice, time-of-day, motives for driving, route planning, etc.	Understanding the impact of alcohol, fatigue, low friction, rush hour traffic, peer-age passengers, etc.	Understanding the importance of personal motives, self-critical thinking, etc.
Driving in Traffic	Mastering traffic rules, hazard perception, etc. Automating elements of the driving process. Co-operating with other drivers, etc.	Understanding the risks associated with disobeying rules, close-following, low friction, vulnerable road users, etc.	Calibration of driving skills, developing a personal driving style, etc.
Vehicle Control	Mastering vehicle functioning, protective systems, vehicle control, etc. Understanding the impact of physical laws.	Understanding risks associated with non-use of seat belts, breakdown of vehicle systems, worn out tires, etc.	Calibration of car control skills

Drawing on individual programs for evidence, and by way of example, this review examined the efficacy of five approaches adopted for the provision of RSE in schools. These include curriculum-based, multi-modal, driver training, one-time interventions, and holistic or indirect approaches. Identifying the strengths and weaknesses of these approaches provides a basis upon which judgements can be made regarding the effectiveness of different methodologies, which may, in turn, be judiciously applied in the consideration of programs of a similar nature. The present paper briefly describes the results of this review (published elsewhere, see Raftery & Wundersitz, 2011), identifies how current approaches may be improved, and offers some guidance for the future development of RSE.

The efficacy of current approaches to school-based RSE

Curriculum-based approaches involve the inclusion of road-safety specific subjects or the integration of road safety themes within existing subjects such as maths, science, and English (also known as the cross-curricula approach). Curriculum-based approaches enable the delivery of developmentally appropriate RSE to students of all ages and usually involve multiple sessions delivered over the course of a term, semester, or school year. However, one of the main issues associated with the addition of road safety subjects to any school curriculum is that of space. Schools are under increasing pressure to include education in a range of special interest topics, including road safety, all of which need to be included within curricula that are already filled with important core subjects. Special interest education programs, particularly those seeking to improve adolescent outcomes must seek to maximise their effectiveness within the constraints of the curriculum; a means to achieve this is discussed below. Curriculum-based RSE programs are perhaps the least evaluated of all RSE programs. This lack of evidence makes further comment on the effectiveness of programs adopting such an approach problematic.

Multi-modal approaches to RSE involve creating safer road environments around schools through the use of engineering treatments (e.g., pedestrian crossings) which are supplemented with educational components to teach students how to use these and encourage them to become safe, responsible road users. Evaluations of such approaches have generally revealed that multi-modal programs meet with limited success. For example, Couch, McCutcheon, and Cirocco (2001) found that schools involved in the Safe Routes To School (SRTS) program in South Australia reported improvements in the management of traffic around schools that reduced concerns of students being hit by a car. However, a Victorian review comparing SRTS schools to non-SRTS schools (Cairney, 2003) found that the extent of RSE in both across each school type was comparable. Cairney (2003) also reports interesting findings with regard to road using behaviours: pre- and post-program road side observations revealed that students from SRTS schools were more likely to use school crossings and adopt appropriate crossing procedures, however they were less likely to stop at the kerb, and there were no differences between schools in terms of students running across the road. Students from SRTS schools were also more likely to wear bicycle helmets correctly, although the actual number of correctly worn helmets across all observation sites was quite small (Cairney, 2003).

Driver training is often touted as a panacea for young driver safety. Previous reviews of driver training programs (see, *inter alia*, Christie, 2001; Roberts & Kwan, 2008) have identified a limited number of well designed evaluation studies. These reviews have shown that driver training programs fail to demonstrate gains in road safety and may, in fact, have the opposite effect (Christie, 2001). The failure of training programs are generally attributed to a number of factors including that training tends to produce over-confidence in young drivers and, in many cases, also lead to early licensing (Christie, 2001; Engstrom et al., 2003; Roberts & Kwan, 2008; Vernick et al., 1999; Woolley, 2000). Furthermore, while training may impart vehicle handling skills for safer driving, it generally does not address the factors that lead to crashes (e.g., the higher order factors of the GDE matrix) and there is no guarantee it will lead to safer driving practices. Indeed, some have suggested that training that instills young drivers with an inflated sense of confidence in their driving ability may see

them drive with less care, increasing the potential for getting caught up in otherwise avoidable hazards (Christie, 2001; Langford, 2003).

One-time interventions are programs that are generally provided by agencies with a key interest in road safety, for example, emergency services (police, fire, and ambulance). These programs generally involve a range of delivery methods including presentations by experts (e.g., police officers) and demonstrations (e.g., a mock crash scenario) that are of short duration, typically conducted on a single day and lasting for only a few hours. This is perhaps one of the primary short-comings of such programs which are generally conducted in isolation (i.e., not embedded within an existing road safety framework) and lacking in supplementary exercises designed to extend the content of the program beyond its initial delivery. Furthermore, the organisations that deliver these programs share common goals yet have a tendency to adopt an individualistic approach to achieve this. That is, at least in South Australia, one-time programs are generally delivered independently of each other and also have different themes or messages. The effectiveness of one-time interventions may be improved through the adoption of a more coordinated approach such that programs adopt a unifying theme and deliver content that supplements each other.

One-time interventions have a number of characteristics that make them an attractive and popular approach to RSE. The nature of these interventions is such that they offer a welcome departure from traditional class-room lessons; the manner in which content is delivered is generally designed to encourage interaction from students, while content such as mock crash scenarios or demonstrations of braking distance can effectively attract and hold an individual's attention (and thus increase the potential for learning to occur). Perhaps the greatest asset of the one-time intervention, however, is the expert presenter. Market researchers have long recognised that successful message delivery is related to the credibility of the source. There is a plethora of research identifying the effects of source credibility on persuasion and attitude change with a general consensus being that sources perceived to have high credibility are more persuasive and are also more likely to produce attitude change (for an extensive review see Pornpitakpan, 2004).

In terms of over-all effectiveness Hatfield, Friswell, Olivier, and Grzbieta (2009) provide some evidence that a day-long, multi-session one-time intervention (the Australian Youth and Road Trauma Forum) can have a positive effect on students' attitudes and behaviours for up to six months following the program. However, these findings were obtained six months following the Forum through focus group discussions with a small sample (N = 23) of students not entirely representative of the 2008 YRTF cohort. Gains in students' understanding of issues surrounding risky behaviours demonstrated by the focus groups also proved equivocal. Further comment on the effectiveness of one-time interventions is difficult as these programs include a range of different approaches and there is a general lack of evidence from well-designed evaluations.

Programs that adopt an holistic or indirect approach to RSE target the causal aspects of problem behaviours in general and seek to overcome these by increasing the resilience of adolescents. Resilience within the present context refers to the individual's ability to cope with adverse situations or risks (e.g., substance use,

delinquency, etc.) that they encounter (Stajduhar, Funk, Shaw, Bottorff, & Johnson, 2009). As such these resilience-based programs seek to increase adolescents' understanding of risks and provide knowledge and skills necessary to make safe decisions about risk behaviours. Evaluations of one such program, *Reduce Risk Increase Student Knowledge (RRISK)*, demonstrate the utility of this approach. Using pre- and post-intervention data collected from 1,996 students attending RRISK (36% of sample) and two control groups (64% of sample combined) Zask, van Buerden, Brooks, and Dight (2006) identified that students who had attended the *RRISK* program achieved some improvements in knowledge and understanding of some risk-taking issues, however those areas showing most improvement were not directly related to safe driving behaviour.

In another evaluation Senserrick, Ivers, Boufous, Chen, Norton, Stevenson, et al. (2009) utilised data from the DRIVE study (see Ivers, Blows, Stevenson, Norton, Williamson, Eisenbruch, et al., 2006) to compare the *RRISK* program to a road safety program directly targeting driving behaviour. Comparison of these programs in terms of participant involvement in crashes revealed that the driving focussed program had no impact on crash risk (adjusted RR: 1.00, [95% CI: 0.81 - 1.23]) while participation in *RRISK* produced a 44% reduction in crash risk (RR: 0.56, [95% CI 0.34 - 0.93]). While *RRISK* may have a positive effect on crash outcomes for young drivers, its influence on general driving behaviour is more equivocal with further analysis finding that neither program demonstrably reduced the likelihood of committing traffic offences, or, at least being detected doing so (Senserrick et al., 2009).

Based on the above review it is apparent that evidence regarding the effectiveness of RSE programs is somewhat equivocal. Current RSE programs possess a number of characteristics, both desirable and otherwise however, due to a lack of well-designed evaluation there is a dearth of evidence to indicate either the success or failure of these. What is clear, however, is that improvements in the provision of RSE are possible.

Improving the provision of road safety education

The first step to improving RSE is to develop sound knowledge of what does and does not work. Indeed guidelines for the provision of RSE in schools stipulate that all RSE should be evidence based (Saunders & Miller, 2009). Further to the provision of this evidence evaluations also provide opportunities to learn from the successes and failures of existing programs ensuring the continued evolution of RSE, and that ineffective approaches are discontinued and new methods developed (Hoekstra & Wegman, 2011). A failure to evaluate belies the importance of road safety, and effectively denies students access to the best RSE available.

The majority of RSE programs developed and provided by third parties (i.e., organisations outside of the education system) tend to focus on the very young or adolescents of driving age (for a detailed discussion see Raftery & Wundersitz, 2011). While the rationale for targeting these age-groups is sound it does mean that, with the exception of curriculum-based RSE, early adolescents in the late primary or early high school years are sometimes overlooked. There exists an opportunity to implement programs that would serve as a precursor to the more driver-focused RSE

that follows in later years. One possible solution to address this deficit is discussed in greater detail below.

Another limitation of many RSE programs is that the majority of these programs are available only to school students. While schools afford ready access to large numbers of students of all ages, programs that are provided in-school only will fail to reach a number of key groups. First, programs targeting young drivers may not reach students who leave school to commence work or an apprenticeship. These individuals are also young drivers who would benefit from RSE however, with the exception of driver instruction or self-enrolment in driver training there is little in the way of community-based RSE programs available to these. Second, students who are truant will likely not receive RSE and thus miss out on any potential benefits. This group is recognised as being at high risk in a number of areas including substance use and delinquency, and are further likely to be high-risk drivers and have the most to gain from road safety education (Somers & Gizzi, 2001; Weden & Zabin, 2005). This increased level of risk for some students provides another area in which RSE may be improved.

Existing school-based RSE programs tend to adopt a fairly generalised approach in order to target as many students as possible. Such an approach may prove effective for the majority of individuals who tend to be relatively low-risk, however it is likely that high-risk individuals would require a more sophisticated approach. For example, within the field of forensic psychology it is recognised that the level of intervention required to change the behaviour of offenders should be consistent with the individual's level of risk (Andrews & Bonta, 2002). Research indicates that low-intensity interventions are effective for low-risk individuals but ineffective for those who are high-risk, while high intensity interventions are effective for high-risk individuals, but have a negative affect for low-risk individuals, effectively increasing their level of risk (Andrews & Dowden, 2005). One way to address this variability in risk is the development of a range of RSE programs that are sensitive to the individual's specific level of risk. It would also be necessary to develop an instrument for assessing the level of driving risk for different individuals in order that they be diverted to the appropriate program. Further research addressing these issues is required.

Finally, the current approach to school-based RSE could be improved through the adoption of a more concerted and coordinated approach. At present, curriculum-based approaches have no fixed place within the curriculum and are largely implemented at the discretion of individual schools. It appears that the primary cause of this is the lack of room within existing curriculum and teaching schedules. Furthermore, there is a lack of coordination between external RSE program providers, many of whom adopt a different perspective for achieving the same goal. These providers should be encouraged to collaborate in the development of programs that share a unifying theme (e.g., highlighting the consequences of decisions and actions) and supplement each other such that each program builds on the lessons of the others. This would in effect produce a multi-session program (compared to the one-time nature of existing programs) that could potentially produce an extended, more effective learning process. The provision of RSE in schools should seek to integrate these one-time programs with curriculum-based approaches through the development of a framework.

Based on the above observations it would appear that there exists the potential to implement RSE programs for students in early adolescence that overcome the shortcomings of the current RSE paradigm. The nature of such a program is described below.

The future or RSE: A program for early adolescents.

Adolescence is a developmental period during which involvement in some form of risk-taking behaviour is statistically normative (Ayers, Williams, Hawkins, Peterson, Catalano, & Abbot, 1999; Brame & Piquero, 2003; Farrington, 1995; Moffitt, 1993). Research indicates that substance use, risky sexual behaviours, and other forms of delinquency (e.g., violent behaviour, stealing, and offences against public order) commence during adolescence (Ayers et al., 1999; Brame & Piquero, 2003; Farrington, 1995). Obtaining a licence during this period also provides some with another avenue for risk-taking. Furthermore, there is a growing awareness that risk-taking behaviours share common aetiologies and that risky driving is but a manifestation of an individual's underlying propensity for risk-taking (Griffin, Botvin, & Nichols, 2004; Richer & Burgeron, 2009; Turner & McClure, 2002). RSE programs that adopt an holistic or indirect approach to RSE recognise this and seek to improve road safety by strengthening the individual's resilience (Griffin, Botvin, & Nichols, 2004). Evidence of the efficacy of such an approach can be observed in the success of the LifeSkills Training program operating in the United States of America (Griffin, Botvin, & Nichols, 2004).

LifeSkills Training is a resilience-based program that utilises cognitive-behavioural techniques such as group discussions, modelling, rehearsal, feedback, reinforcement and "behavioural homework" to teach cognitive-behavioural skills for improving self-esteem, resisting external pressures (e.g., advertising and peer pressure), managing anxiety, effective communication, increasing assertiveness, and developing and maintaining interpersonal relationships (Griffin, Botvin, & Nichols, 2004). It is delivered in 24-30 sessions over a 2-3 year period for either late-primary or early high school students. The LifeSkills Training approach involves an integration of generalised education that addresses the risk behaviour in general with domain-specific material that targets factors specific to the targeted behaviour. In essence, domain specific materials address the knowledge, attitudes, norms, and skills associated with a target behaviour (e.g., substance use), while the generic skills provide the conditions or foundations upon which these new skills are built.

The LifeSkills Training program was originally developed in order to target substance using behaviour. Employing a randomised block design allocating schools to both treatment and control conditions, a longitudinal evaluation of the program based on pre- and post-testing (undertaken at a three year follow up) of 3,684 (51% male; 91% white) students identified significant prevention effects with regard to cigarette, cannabis, and alcohol use (Botvin, Baker, Dusenbury, Tortu, & Botvin, 1990). This program was also found to have a positive influence on HIV risk behaviours (e.g., multiple sex partners, sex while intoxicated, and high-risk substance use) (Griffin, Botvin, & Nichols, 2006). This success has seen the application of LifeSkills Training to the areas of violence and delinquency, where it has been shown to produce significant reductions in delinquency and physical violence (Botvin, Griffin, & Nichols,

2006). These evaluations also indicate that the program produces these protective effects for students who attend a minimum of 60% of the program's sessions. Perhaps, given the scope of the present paper, the most interesting findings with regard to LifeSkills Training, however, are those that are related to driving behaviour.

Based on data collected for the evaluation of the original LifeSkills Training program Griffin and colleagues (2004) sought to determine the potential influence of this program on risky driving outcomes based on official records of traffic violations. After controlling for effects of gender and alcohol consumption they found that students who received the LifeSkills Training program were less likely to have violations on their driving records relative to a control group of students. Further analysis revealed that the effects of the LifeSkills Training program on risky driving were mediated by the program's positive influence (i.e., it improved) on anti-drinking attitudes (Griffin, Botvin, & Nichols, 2004). As these changes were observed based on a program with no overt road safety element, the development of a similar program with a more specific focus on road safety is an exciting prospect and warrants further investigation.

The future of road safety education in Australia should give serious consideration to the development of an RSE program (or programs) based on the principles and design that underpin LifeSkills Training. There are a number of benefits for adopting such an approach. First, the holistic approach to risk-taking adopted by LifeSkills Training is clearly in line with the highest level of the GDE matrix. It has also been demonstrated that the adoption of such an approach yields significant benefits with regard to a range of risk-taking behaviours, including risky driving. The development of a similar program for inclusion within Australian school curricula would thus enable the education sector to address a range of problem areas with one well-designed program, maximising the use of limited, valuable space in the curriculum.

One-time interventions also have an important role to play. An integral aspect contributing to the success of the LifeSkills approach is the provision of domain specific education. This role could be filled through the adoption of the coordinated and integrated provision of existing one-time interventions outlined above. Existing one-time programs will, however, require some modification.

Furthermore, the key to the success of the LifeSkills program is arguably the cognitive-behavioural approach to the provision of the skills to lead a successful, adaptive, healthy, and risk-free life. Instilling these life-skills in individuals provides the foundations upon which higher-order skills are based. Therefore, given the current lack of programs for early high school students there is an opportunity to bridge this gap through the provision of an holistic program. Such a program has the potential to produce a number of benefits, including ameliorating the harms associated with a range of adolescent risk behaviours and improve the effectiveness of RSE (and other) programs that follow.

Future research

In order to ensure the continued evolution of RSE a number of knowledge gaps requiring further investigation have been identified throughout the preceding discussion. Furthermore, the development of an holistic cognitive-behaviourally

based RSE program such as that proposed herein should be guided by a program of research (and evaluation) that identifies the content and delivery methods relevant for Australian audiences.

Conclusion

The development of a program for early adolescents that employs cognitive-behavioural methods across multiple sessions offers a parsimonious option for a curriculum-based approach to address a range of issues associated with adolescent risk-taking. The robust evaluations of the LifeSkills Training approach provide strong evidence that one well-designed program can effectively improve adolescent outcomes for a range of risk-taking behaviours.

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