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The efficacy of road safety education in schools: A review of current approaches

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ABSTRACT

This report provides an overview of current road safety education (RSE) programs for school students that are currently in use in Australia and overseas with the primary aims of commenting on the effectiveness of current approaches, and to identify any gaps in the provision of RSE. To this end the report was necessarily restricted to the inclusion of RSE programs that have been evaluated or that are comparable with similar programs that had. RSE programs were categorised according to the five primary strategies adopted: indirect or holistic approaches, one-time interventions, driver training, curriculum-based, and multi-modal approaches. The lack of well-designed evaluations makes commenting on the short- and long-term efficacy of RSE programs problematic, however the report makes use of evidence from a variety of sources to facilitate an informed discussion. The effectiveness of current road safety educational programs remains largely undetermined as there is little evidence showing that RSE either does or does not work, although programs addressing the general causes of risk taking behaviour are showing some promise. In general current approaches do not appear to cause harm, unless they promote early licensing, and there would be expected to be an inherent value in passing on road safety knowledge. Suggestions for improvements and future directions for RSE are also offered.

KEYWORDS

Road safety, road user education, school, strategies, evaluation, effectiveness

Summary

Road safety education (RSE) in schools is one potential way of reducing the number of deaths or injuries amongst young road users. Indeed, OECD countries have made RSE in schools a priority (OECD, 2004), which has led to the proliferation of educational programs using a variety of strategic approaches and delivery methods. Organisations with an interest in road safety (e.g., emergency services, motoring organisations, governments, health professionals, and community groups, etc.) are continually looking for new and innovative ways to improve road safety knowledge and promote safe, responsible road use. However, common criticisms of school-based RSE programs often point to a lack of evidence proving their effectiveness, and that schools themselves are often hard-pressed to find time in already full curricula to schedule additional activities. The purpose of this report is to review the strategies and methods utilised by current RSE programs offered in schools and to provide some comment on the efficacy of these.

To this end a number of Australian and international programs from the last decade were identified. Generally speaking RSE programs can be classified according to the educational strategy they adopt, these strategies are:

- Indirect or holistic approaches
- One-time interventions
- Driver training
- Curriculum-based or cross-curricula approaches
- Multi-modal approaches

FINDINGS

A review of the literature produced the following findings:

- RSE programs that promote early licensure may negate gains in knowledge by increasing driving exposure, and thus, exposure to crash risk.
- Traditional training programs that focus on vehicle emergency handling skills (e.g., skid control, etc.) have been demonstrated to increase the risk of crashing.
- RSE programs targeting causal factors of risk taking behaviour show promise with regard to reduction in crashes amongst young drivers.
- In South Australia curriculum-based approaches are currently independently implemented by schools according to their needs.
- Whilst some delivery methods may facilitate learning more than others, for many there is a failure for gains in knowledge to be translated into behaviour.

GAPS IN RSE PROVISION

Of the programs reviewed it is clear that there are very few programs available for early high school students. This age group appear to be in a void as they have already received basic road safety for pedestrians and cyclists, and are too young for programs aimed at young drivers. RSE for this group should consider issues of being a passenger, while the potential exists to build a foundation to underpin the more driver-focussed programs they will encounter in the future.

CONCLUSION

This review discussed the efficacy of a number of RSE programs from a number of perspectives. In general there are problems with identifying RSE outcomes that are suitable indicators of a program's effectiveness while the implementation of comprehensive evaluations is often limited by issues of practicality and feasibility. It is likely that the problems inherent with program evaluation will persist for some time to come, as such we will not know with any certainty how effective RSE programs are. While driver training and programs resulting in early licensure have proven problematic the majority of RSE programs likely have some positive effect, and at the very least do not produce harm. At present, programs that indirectly address road safety by targeting aspects of resilience and risk taking are showing some promise. The development of RSE programs in the future should be evidenced based and founded on established principles of best practice for both education and behaviour change.

Contents

1 Introduction

1.1 Background

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. The demand for education is often based on assumptions that young road users lack the skill, knowledge, or both to operate safely in traffic environments, and that addressing these deficits will reduce their risk of being injured or killed on or around roads. In recognition of this road safety education for school-aged children and adolescents has become a priority for OECD countries (OECD, 2004), with a particular focus on the development of school-based road safety education programs. Schools are attractive candidates for the delivery of road safety education because their primary role is education; they possess the teachers and resources (e.g., classrooms, computers, multi-media facilities, etc.) necessary to deliver road safety education. In Australia most individuals will attend school at some point in their life. As such they are the singularly most efficacious means for delivering road safety education to large numbers of the intended audience. Given the resources required to develop a road safety program and other competing health initiatives vying for limited time in teaching schedules, it is imperative that it is understood what road safety programs, if any, are most effective in a school-based learning environment.

The purpose of the present report is to provide a review of current road safety education programs available to school students and to further comment on their effectiveness. As such this review has focussed on programs that are in use, or have been within the past 10 years, in Australia and overseas and that have been the subject of evaluation. Programs currently in use in South Australian schools have also been included, even where no evaluation was available, as have any other program that either adopts a novel approach to road safety education, or shows some promise (based on best practice principles, etc.).

1.2 Organisation of the report

The term “Road Safety Education” encompasses a large range of activities and methodologies for addressing road safety issues from a number of perspectives. Indeed, the road safety education strategy depends largely on the perceived cause of crash related harm for young people. Drawing on a number of Australian and international programs as exemplars this report describes and discusses school-based road safety education strategies under the following categories:

- Indirect or holistic approaches: Strategies that target the causal aspects of problem behaviours in general, for example, risk awareness, resilience, and problem solving.
- One-time interventions: These are usually one-off programs of short duration that may involve school visits from road safety educators from outside organisations (e.g., police or fire services). Programs that utilise this approach may utilise confronting imagery or exhibitions to graphically and realistically portray the consequences of crashes. Other educational tools or methods utilised may include interactive exhibits that either emulate or simulate driving related skills (e.g., reaction time).
- Driver training: A number of road safety programs have sought to improve road safety through the provision of training that is intended to improve the young driver’s ability to control a motor vehicle.

- Curriculum or cross-curriculum based: Specific road safety subjects in the curriculum, or incorporation of elements of RSE into other subjects (e.g., Physics, English, Physical Education, Health, etc.).
- Multi-modal: Programs that supplement education with other strategies, for example, engineering enhancements to pedestrian infrastructure, encouraging healthier environmentally sustainable travel options, or targeted enforcement strategies.

A table summarising the programs included in this report is available in Appendix A.

In order to ascertain the effectiveness of different approaches to RSE this report draws on the results of program evaluations, as such it is necessary to have an understanding of evaluation methods in order to develop an appreciation of how the quality of the evaluation influences the quality of the evidence it provides. In the past few studies have employed rigorous scientific evaluation methods due to a number of factors including poor planning, lack of resources (including financial support), practical issues (e.g., the use of control groups), and a failure to adequately control for sample biases (e.g., randomised trials). These issues are discussed in more detail in section 2.

2 Evaluation of school-based road safety education

School-based road safety education programs aim to improve the road safety behaviour of children and adolescents. Given the many different types and forms of school-based road safety education programs, it is important to understand which programs are most effective. Comprehensive evaluations are necessary for determining the effectiveness of a program and for providing directions as to how future programs might be improved. However, conducting evaluations of road safety education programs is not a simple task. Evaluators need to understand the program they are evaluating and what type of effects might be expected from the program within the given time frame for program implementation and follow-up evaluation (Dragutinovic & Twisk, 2006).

Two main types of evaluation used to assess program effectiveness are process and outcome evaluations:

- Process evaluations assess the implementation of the program such as the effectiveness of the program delivery, the extent to which the program reaches the target audience and the appropriateness of the program content.
- Outcome evaluations attempt to determine the effectiveness of the program in terms of the desired outcome within a defined population. Typically, such evaluations examine changes in knowledge, self-reported attitudes or beliefs, behavioural intentions or, to a lesser extent, behaviour (observed or official records).

A reduction in the number of crashes or injuries resulting from a crash might be considered the main outcome for measuring the effectiveness of a road safety education program. However, there are a number of problems with crashes as an outcome measure. Crashes are a relatively infrequent event therefore data needs to be collected over a reasonably long period of time to accrue sufficient data to detect meaningful differences (see Evans, 2004). Crashes can also be influenced by a variety of different factors such as the economy and other countermeasures, some of which can not be controlled for. Consequently, it is not easy to establish which factors or combination of factors might be responsible for a change in crash numbers. For these reasons, very few school-based road safety education campaigns have been evaluated using crashes as an outcome measure.

The goal of many road safety education programs is to foster the development of attitudes under a belief that attitudes are the precursor to behaviour. While this is true in some cases, studies examining the relationship between attitudes and behaviour have found that attitudes are not always the best predictors of behaviour (see, for example, Cooke & Sheeran, 2004; Stacy, Bentler, & Flay, 1994). This has a number of implications for the evaluation of road safety education programs. Where the goal of a program is simply to change attitudes then assessment of attitudes alone is a sufficient indicator, however, where programs seek to influence behaviour any assessment of attitudes may be enhanced by some evaluation of behaviour.

For the most part, evaluations should:

- Be based on before and after comparison of behaviours or variables that can be objectively observed and are closely linked to the program goals or objectives.
- Allow sufficient time prior to the program for the “before” measurement to be conducted. However, often the time between commitment to a program and its commencement is too short for a baseline measurement to be planned and take place.

- Include a control group that has similar characteristics to the 'treatment' group but does not participate in the program. Ideally individuals should be randomly assigned to one of these groups to minimise individual differences that might lead to self-selection bias (e.g. more safety orientated individuals might choose to participate in a program), particularly when participation in the program is of a voluntary nature.

There are few rigorous scientific evaluations of programs where students are randomly allocated to treatment or control groups, with a before-after comparison being made in both groups. This is because:

- In reality the inclusion of a control group is not always feasible, particularly when complete populations are targeted, or ethical (should a program with potentially positive health outcomes be provided to some but not others).
- Randomised trials are difficult and expensive to conduct.
- In many cases program providers do not have the expertise or resources necessary to conduct a scientific evaluation. In an effort to improve the quality of road safety education programs, Queensland Department of Transport and Main Roads (2009) developed a guide for program providers to evaluate the effectiveness of their programs.

Road safety education is generally not an isolated event but continues over a long period of time. Consequently, it is difficult to determine what effect school-based road safety education might have independent of other road safety initiatives. In addition, realistic expectations of what school-based road safety education might achieve are necessary; it may not directly change behaviour but may be useful for helping to form beliefs or reinforce existing beliefs. Also, it may be difficult to prove that any single education program has had an effect, but it is possible that there is a cumulative effect over a period of years.

3 Indirect or holistic approaches

Adolescence is a period characterised by physiological, cognitive, psychological, and social changes. With these changes come new freedoms and responsibilities that must see the adolescent navigate their way through a raft of social and developmental challenges (e.g., peer pressure, romantic relationships) on their way to becoming an adult. It is well documented that adolescence is also a period characterised by risk taking behaviour, including substance use, risky sexual behaviour (promiscuity, unsafe sex, etc.), and delinquency as adolescents strive to overcome these challenges and resolve uncertainties surrounding their identity (Ayers, Williams, Hawkins, Peterson, Catalano & Abbott, 1999; Brame & Piquero, 2003; Farrington, 1995; Marcia, 1966; Moffitt, 1993; Schwartz, 2001). Adolescence also brings with it a new avenue for exploration and freedom as individuals obtain a driver's licence and eventually become regular users of that which, for many adolescents, is the epitome of maturity, status, and freedom - the car. There is an increasing amount of evidence that shows adolescent risk taking extends to their use of motor vehicles with studies showing adolescents' participation in behaviours such as speeding, following too closely, not using a seat belt, using a mobile phone while driving, and violating traffic rules (Fergusson, Swain-Campbell, & Horwood, 2003; Ivers, Senserrick, Boufous, Stevenson, Chen, Woodard, et al., 2009; Turner & McClure, 2003). Furthermore, global trends also show that young drivers are over-represented in crash statistics (Ivers, Blows, Stevenson, Norton, Williamson, Eisenbruch, et al., 2006).

In order to ameliorate the harms associated with adolescent risk taking behaviour a number of school-based strategies have been developed and implemented to address these issues. Traditionally these programs have had a tendency to focus on single issues, for example, road safety or substance use, however there is a growing recognition that adolescent risk-taking behaviours share common aetiologies (e.g., Griffin, Botvin, & Nichols, 2004; Turner & McClure, 2002) and that addressing the underlying factors common to these behaviours may be a more effective method of addressing adolescent risk taking behaviours (Griffin, Botvin, & Nichols, 2004). The RRISK (Reduce Risk Increase Student Knowledge) is one such program that adopts a holistic approach to road safety education and substance use.

3.1 Reduce Risk Increase Student Knowledge (RRISK)

Targeting year 11 students the "Reduce Risk, Increase Student Knowledge" (RRISK) program seeks to ameliorate the harms associated with substance use and risky driving by developing or strengthening students' *resilience*[1] to extrinsic and intrinsic pressures to engage in these behaviours. RRISK has been running in the North Coast region of New South Wales since the mid 1990s; its success has seen it expand to include Mid-North Coast regions in the latter half of this decade (Dight, Dart, Zask, Hughes, & Lord, 2009). All high schools in the program catchment area are invited to attend the RRISK seminars that are conducted on eight occasions across four sites. In 2008, 2,929 students from 48 schools (approximately 85% of all schools in the catchment area) attended, a marked increase from the 22 schools that attended in 2006 (Dight et al., 2009). RRISK is a one-day seminar incorporating a number of sessions involving guest speakers, peer facilitated small group activities, and a simulated crash scene. This seminar is further supplemented by in-school activities, that are implemented at the discretion of each individual school.

[1] Resilience to adversity has been variously defined (see Roisman, 2005), however, in the present context resilience may be thought of more generally as an individual's ability to resist or cope with adverse situations or risks (e.g., substance use, delinquency, etc.) they encounter (Stujduhar, Funk, Shaw, Bottorff, & Johnson, 2009).

One of the key principles of the RRISK program is to provide students with the most up-to-date information and statistics so that they can make informed decisions when it comes to risk taking behaviours. A number of sessions involve guest speakers who provide up-to-date information and statistics regarding substance use, risk taking behaviour, and why young drivers are at a greater risk of injury due to crashes. The session on substance use aims to dispel myths, discuss the risks associated with alcohol, cannabis, ecstasy, and amphetamines, and identify measures that can be taken to avoid engaging in risky behaviours and reducing harmful outcomes. There are also sessions on being a safer driver, which covers risk factors and the most common causes of crashes for young people, and another offering practical advice for purchasing and maintaining a safe vehicle. There is also a presentation by a young man whose substance use led to a crash which killed his two young female passengers and resulted in his own permanent injuries (Zask, van Beurden, & Dight, 2005).

In order to determine the effectiveness of RRISK, Zask, van Beurden, Brooks, and Dight (2006) compared the pre- and post-intervention survey data of the treatment group (students who attended the RRISK seminar) and two control groups, one consisting of comparison schools that did not attend the seminar, and another consisting of students from schools who participated in the program but did not attended the seminar. It should be noted that while comparison schools were not part of the RRISK program other activities and programs were routinely undertaken (Zask et al., 2006). Pre-intervention data was gathered from 2,705 students (56% female), of whom 46% were in the intervention group, with post-intervention data available from 1,996 students (56% female), of whom 64% were in the control group (19% in the “no seminar” group, the remainder from comparison schools). Analysis of the self-reported attitudes, knowledge, and behaviour of participants showed that students who attended the seminar had significantly higher levels of knowledge regarding used car safety and determining if someone is too drunk to drive. Participants who attended the RRISK seminar also demonstrated significant improvements compared to control group members in attitudes relating to three key areas: participants who attended the seminar had significantly increased understanding of risk and attitudes regarding the use of drugs and/or alcohol at parties, and also that people who attend parties should know CPR (cardiopulmonary resuscitation). Furthermore, participants in the older cohort[2] intervention group reported significant improvements in planning safe returns from parties compared to controls, however comparison group members of the younger cohort self-reported significant improvements with regard to looking after friends when partying.

The above findings suggest that the RRISK seminar is successful at achieving some of its expressed aims with regard to risk-taking behaviour. However, those areas showing positive improvements are not specifically related to safe driving behaviour (although there are suggestions that addressing substance use can reduce the risk of crash involvement, see below). The latency between intervention and post-test data collection is not clearly defined (i.e., it is unclear if post-intervention data were collected immediately following the seminar or some time later) making it difficult to ascertain whether these findings represent short- or long-term effects. Furthermore, self-report data may be biased such that students may either under-represent some behaviour or attitudes or over-represent others in order to be perceived more favourably. There is no means for determining the extent of this for the above study.

A separate study conducted by Senserrick and colleagues (Senserrick, Ivers, Boufous, Chen, Norton, Stevenson, et al., 2009) compared the RRISK program to a one-day workshop that focuses primarily on issues related to safe driving (see Senserrick et al. for a description of the program) and is

[2] Evaluation participants were further dichotomised based on their age. The Older cohort were aged 16 at baseline and 17 at follow up, while those in the Younger cohort were 15 at baseline and 16 at follow up.

considered by the authors to be more driver focussed. Data was gathered as part of the DRIVE study, which followed a cohort of 20,822 young drivers in New South Wales (see Ivers, Blows, Stevenson, Norton, Williamson, Eisenbruch, et al., 2006). It should be noted that participation in the DRIVE study was entirely voluntary, requiring registration and completion of surveys via the Internet, which may have introduced a self-selection bias. The outcomes of both programs were assessed in terms of the risk of being involved in a crash using official crash records from the Roads and Traffic Authority of NSW. Univariate and multivariate analyses revealed that, relative to the remainder of the cohort (i.e., all other subjects in the DRIVE study) the driver focussed program had no impact on risk of being in a crash (adjusted RR: 1.00, [95% CI: 0.81 - 1.23]) while participation in RRISK, even after controlling for confounding variables (e.g., driving exposure, etc.) produced a 44% reduced risk of being in a crash (RR: 0.56, [95% CI: 0.34 – 0.93]). An interesting aside is that this study revealed there was no association between participation in either program and risk for accumulated traffic offences, that is, attendance at either program did not demonstrably reduce the likelihood of committing traffic offences, or, at the very least, being detected doing so by police.

These findings provide evidence that the RRISK effectively improves road safety among young road users. It also appears that its approach focussing more generally on resilience to risk is more effective than programs that focus solely on safe driving. However, while the above study demonstrates a reduced likelihood of being involved in a crash, the findings are rather more equivocal with regards to traffic offences in general. The lack of any clear advantage in terms of reduced traffic infringements for either group compared to other drivers in the DRIVE cohort implies that young people that attend RRISK are just as likely to engage in risky driving behaviours that are likely to draw the attention of police through either passive (e.g., speed or red light cameras) or direct means.

3.2 LifeSkills Training program (US)

Some evidence of the success of a multi-faceted resilience-based approach such as that adopted by RRISK comes from an international study examining the effects of an evaluation of the LifeSkills Training program provided to primary and lower-high school students in the United States of America (Griffin, Botvin, & Nichols, 2004). The LifeSkills Training program is a resilience-based program that addresses substance use risk by providing the knowledge and skills needed to effectively resist pressures to engage in substance use and to remove the motivations to use substances. The program uses techniques such as group discussions, modelling, rehearsal, feedback, reinforcement and "behavioural homework" to teach cognitive-behavioural skills for improving self-esteem, resisting advertising pressure, managing anxiety, effective communication, increasing assertiveness, and developing and maintaining interpersonal relationships (Griffin, Botvin, & Nichols, 2004). Utilising data collected for the evaluation[3] of the 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. Their analysis revealed that males and individuals who regularly used alcohol were more likely to have a history of driving violations than females and non-regular alcohol users respectively. Furthermore, 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 programs positive influence (i.e., it improved) on anti-drinking attitudes (Griffin, Botvin, & Nichols, 2003).

[3] The original evaluation of the LifeSkills Training program was conducted to assess its efficacy for reducing risks associated with substance use. Road safety was not a component of that evaluation.

The robust design of the LifeSkills Training program evaluation, including a longitudinal design with random allocation of participants to treatment or control groups (see Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995) adds further weight to the above findings. As such there is increasing evidence that programs that seek to enhance resilience to risk in general and that do not specifically target road safety can also have demonstrable positive effects on risky driving. Should evaluations of comparable programs produce similar effects with regards to road safety issues there would be an indication that a range of adverse adolescent outcomes related to substance use, risky driving, and delinquent behaviour, for example, may be most efficaciously addressed by well designed programs that address factors at the core of these behaviours rather than a raft of programs targeting each behaviour independently.

4 One-time interventions

A number of organisations with an interest in road safety (e.g., police and fire services) develop their own road safety education programs as a means to combat the trauma associated with traffic crashes. These programs typically offer short sessions, that can be conducted in schools and are often targeted at specific age groups based on the content and purpose of the program. For example, many such programs target novice drivers and are thus restricted to adolescents who are either close to an age where they can obtain a driver's licence, or are already driving. These approaches may employ a number of techniques to reinforce the consequences of unsafe driving. For example, confronting images of crash scenes, live demonstrations (e.g., to demonstrate stopping distances), or mock crash scenes that reproduce the trauma of a crash site, including rescue procedures and the aftermath (legal, medical, and emotional) for those involved, whilst also demonstrating the rescue and recovery procedures of emergency services. Other techniques may include the use of interactive exhibits that encourage a hands-on approach to learning and allow the individual to develop their own knowledge of different issues. Drawbacks to approaches like these (e.g. Street Smart, RYDA, Youth and Road Trauma Forum) are that they can be expensive to run and require suitable infrastructure (e.g., venue) to make them accessible to the target audience. These limitations impact on the availability and frequency of such programs.

4.1 The Youth Driver Education Program (YDEP)

The Youth Driver Education Program is run by SAPOL and is available to all South Australian schools. The program is delivered in secondary schools to year 11 and 12 students by South Australian police officers. It involves a 90 minute interactive lecture that covers topics including crash statistics for young people (16-24 years) and causes of crashes including fatigue, speed, close following, risk taking, peer pressure, alcohol, drugs, driver distractions (with a focus on mobile phones), and driver attitudes. The primary aim is to show young people how they can reduce the risk of becoming a crash statistic. Over the course of a one-year period 263 (202 in metro schools, 61 in rural schools) YDEP sessions are conducted with approximately 15,800 students (P. Warren, personal communication, June 22, 2010).

The major theme pervading the program is that of choices/risks/consequences, it seeks to highlight that young drivers and passengers have choices regarding the risks to which they expose themselves and others and the consequences that can arise. The presenter reinforces their message through the use of confronting images (of crashed vehicles and crash scenes) and videos (predominantly television commercials), and recounting personal experiences that include what they have seen at a crash scene to the personal costs associated with observing the harms caused and having to inform parents of the death of their child.

One of the more important aspects of the presentation involves the use of salient examples and hypothetical scenarios, and guided questioning to encourage attendees to consider the risks associated with different situations and identifying strategies that may be employed to avoid putting themselves (and/or others) at risk, or to exit risky situations when they arise. The presenter may also offer advice or model strategies themselves. At all times of the presentation members of the audience are encouraged to participate by asking questions or providing answers or opinions on various issues.

Presenters also seek to educate attendees as to how the law views different types of driving behaviour and seeks to highlight how behaviours that may seem largely innocent or fun can have legal ramifications at the very least and, at worst, life-changing consequences.

The YDEP was evaluated in the late 1990s focusing on the areas of content, delivery, and outcomes. Woolley and Taylor (1998) reported that the content and delivery of the program were of a high standard, which appears to be supported by the popularity of the program amongst students who attended. However, self-reported attitudes and driving behaviours were not influenced by the program. Self reported perception of skills and behaviour obtained using the Driver Skills Inventory (Lajunen & Summala, 1995) and the Driving Behaviour Inventory (Gulian, Matthews, Glendon, Davies, & Debney, 1989) showed that perceptions prior to attending the program did not differ significantly to those reported after (Woolley & Taylor, 1998). The authors further acknowledge that interpretation of the results of the evaluation with regard to outcome need to consider the limitations of the sample. The evaluation was limited to 282 (41% male) predominantly public school (84%) students from the Adelaide metropolitan region, of which only 34% had a licence (28% Learner's, 6% Ps). As such the driving experiences of the population are negligible for a large part of the sample, rendering any assessment of driving behaviour somewhat superfluous for 66% of the sample. The remaining 34% of participants with a history of driving may have been insufficient for statistical analysis. Furthermore, Woolley and Taylor (1998) suggest evaluation of the YDEP for rural students would be necessary to confirm these findings for that population.

Since Woolley and Taylor's (1998) evaluation the YDEP has undergone a number of changes that reflect a number of improvements recommended by the report. These changes have resulted in a shorter, more interactive program with alterations to content and delivery that would appear to be more conducive to conveying road safety messages. Due to these and broader social changes the Youth Driver Education Program should be subjected to further evaluation.

4.2 The Road Awareness and Crash Prevention Program (RAAP)

RAAP is a 90 minute program conducted by the South Australia Metropolitan Fire Service (SAMFS) and involves fire fighters visiting high schools and talking to year 11 and 12 students about the dangers of speeding, the consequences of DUI (drugs and alcohol), the impact of a road crash on various groups, and how to avoid risky situations as a passenger. The main message of the program focuses on concentration and commonsense to avoid road traffic crashes. In 2008 the RAAP program was delivered on 65 occasions to approximately 9,000 year 11 students (approximately 44% of the year 11 population) from 40% of South Australian high schools, of which metro and rural schools were evenly represented (R. Campbell, personal communication, June 21, 2010).

The RAAP is conducted in two stages. The first involves a practical demonstration by fire fighters using the "jaws of life" to conduct a road crash rescue. The second involves a classroom presentation by fire fighters explaining the realities of what happens to road crash victims. This presentation also incorporates video footage and photographs of real crashes and victims. Fire fighters also address the lasting trauma from injuries and fatalities caused by crashes. A survivor of a road crash who sustained spinal injuries resulting in quadriplegia supplements this by describing his experiences.

At the end of the program students take home a parent-young person safe driving agreement that are part of the Roads 2 Survival (R2S) program. Roads 2 Survival (Griggs, 2004) provide a number of agreements between young drivers and their parents/guardians or peers that are essentially contracts between groups as to how they intend to drive safely on the road.

At the time of undertaking this review no evaluation of the RAAP program was available. However, a comparable program in New South Wales designed to raise awareness of youth safety delivered by presenters in wheelchairs was re-developed based on principles of best practice, and may offer some insight. Deans and Nisbet (2003) report that effective delivery of such programs should be linked with school curriculum, employ proven teaching and learning techniques, not be delivered in isolation (i.e.,

not stand-alone), and be delivered by presenters with the skills to adequately deliver the program. The program was further improved by changing the structure and planning of the sessions with a shift of focus away from the personal story of the presenter and towards increasing understanding or awareness of risk (Deans & Nesbit, 2003). This is not to say that wheelchair presenters are incapable of delivering such programs, rather their effectiveness at delivering the program may be vastly enhanced by ensuring they have the relevant training and support. It may well be that teaching understanding about risk taking behaviour may be more effective when delivered by a wheelchair presenter if this enhances students perceptions of source credibility.

While the crash demonstration and wheelchair presenter aspect of the RAAP program may prove popular with students and teachers, the ability of the program to effectively deliver a road safety message would benefit from further evaluation. It is likely that the effectiveness of this program could be greatly enhanced by incorporating the improvements mentioned above.

4.3 The Australian Youth and Road Trauma Forum

In New South Wales the Westmead Hospital Trauma Service in conjunction with the NRMA have developed an annual education experience with the intent of reducing the rates of injury and fatality among young people through the promotion of safe behaviours. The Youth and Road Trauma Forum is an annual event that incorporates a crash scene scenario, interactive exhibits, practical demonstrations, and guest speakers into a four-hour program for senior secondary students (years 11 and 12) from NSW and the ACT (Wilson, 2009).

The program incorporates three main elements. The first involves a mock crash scene where students are presented with a crash scene and follow the journey of those involved. The scenario incorporates police, fire, and ambulance officers who demonstrate their role at a crash scene in terms of investigation and patient extrication and care. The scenario enables students to observe the consequences of the crash for the patient, following their journey from resuscitation at the crash scene to the emergency department at hospital, and also following the legal ramifications for the driver.

The second element involves access to a number of interactive exhibits which range from providing more information about the emergency services (police, fire, and ambulance), information regarding blood and organ donation, and displays which demonstrate, amongst other things, driving skills, reaction times, and stopping distances (Wilson, 2009). These displays enable students to explore and gain additional knowledge regarding a diverse range of road safety issues.

The third element entails speakers and practical demonstrations. Speakers provides students with a human face to the traumas associated with brain injury, spinal injury, and organ donation from either those who have experienced these first hand, or from those who work closely with those who have. There is also a demonstration wheelchair basketball game in which a few students participate, and a demonstration of stopping distances (Wilson, 2009).

Feedback from students, teachers, and interactive exhibit personnel regarding their experiences of the Forum indicate that as a medium to deliver a road safety message the program was both interesting and informative providing students with access to a wide range of knowledge and expertise (Wilson, 2009). There was some indication from students who attended that the program had long-term positive effects on the attitudes and behaviours. An evaluation of the 2008 Youth and Road Trauma Forum undertaken by the Injury Risk Management Research Centre at the University of New South Wales in conjunction with the NSW Motor Accident Authority (Hatfield, Friswell, Olivier, & Grzebieta, 2009) sought to assess the Forum's ability to address its intended aims by following-up students six months after attending the Forum. Using focus groups qualitative data was collected from 23 year 11 students across four private high schools. Based on this data Hatfield and colleagues (2009) suggest

that students who attended the Forum retained messages about the serious consequences of crashes and about their responsibility for the safety of themselves and other road users. Other aims of the Forum were less clearly achieved with results from discussion groups proving equivocal with regard to the understanding of issues surrounding risky behaviours and also behavioural safety tips (Hatfield et al., 2009).

There are a number of issues arising from this evaluation that require a cautious approach to interpretation of these findings. First and foremost, the sample utilised for the study was small (23 students) and restricted to students from private high schools, and, as such, may not be representative of the population of interest (all students who attended the 2008 Youth and Road Trauma Forum). Furthermore, the qualitative nature of the data, while providing rich insight into students' perceptions of the Forum, may be subject to bias in the form of socially desirable responding. The nature of the data and the manner in which it is collected also make it difficult to demonstrate any behavioural change arising from attendance at the Forum. Finally, it should be noted that since this initial evaluation was undertaken a number of reforms to the Forum's program, content, and delivery have been made. As such further evaluation is required in order assess the aims and effectiveness of the Forum.

4.4 Street Smart

Drawing heavily on the Youth and Road Trauma Forum the Royal Automobile Association of South Australia (RAA) initiated the Street Smart program. Like the Youth and Road Trauma Forum the Street Smart program incorporates a mock crash scene, practical demonstrations, interactive exhibits, and guest speakers from a variety of interest groups into a day-long program for high school students in years 10-12. The aim of the program is to increase novice drivers' awareness of the seriousness of road trauma by highlighting the consequences of issues such as speed, driver distraction, and substance use. The program further seeks to provide students with the skills and knowledge to improve their ability to assess and avoid unnecessary risks. At its inaugural event in 2009 Street Smart was attended by over 3,500 students from 39 schools across South Australia (although the majority of these were from the metropolitan region) (RAA, 2009)

An evaluation of Street Smart was undertaken, utilising pre- and post-test data. At the time of writing this report only a summary of the program and evaluation findings was available, making any comment on the methodology and quality of the data difficult. The evaluation appears to have mainly focussed on feedback from attendees and other stakeholders (e.g., teachers and presenters) (RAA, 2009). Assessment of attitudes pre- and post-attendance revealed that Street Smart had an impact on attitudes to drink driving and speeding for 90% of attendants. A further indication of the programs potential influence on attitudes was also found with 83% of students reporting Street Smart would impact on their attitudes towards texting while driving. For both these findings there is a failure to indicate what the nature of that impact was (e.g., positive or negative), however it appears that this influence is likely positive. The evaluation also showed that 66% of students stated they wanted a car with good safety features, a rate double that of the one observed prior to attendance at Street Smart (32%).

While these findings offer some indication of the impact of Street Smart on novice drivers' attitudes towards risky driving, it should be noted that these results are based on students' own beliefs and, as such, may be subject to a number of biases, including socially desirable responding. Further evaluation should also include some assessment of behaviour.

4.5 Rotary Youth Driver Awareness program (RYDA)

The Rotary Youth Driver Awareness program (RYDA, 2010) is a one-day event that seeks to help adolescents become safer road users by focusing on attitudes and awareness. The program utilises a number of experts including police, driving instructors, alcohol and drug professionals, financial service advisors, and crash survivors to highlight the responsibilities associated with owning and driving a vehicle, and the rights and responsibilities of passengers and pedestrians. The program is available to high school students aged 16-17 years, as this is the time of their lives when they start to drive or ride in cars driven by their peers. Since its inception the RYDA program has expanded beyond New South Wales and is now offered in South Australia, the ACT, Queensland, Western Australia, and Tasmania.

The program is divided into six sessions addressing various road safety issues relevant to the age group. The following information was obtained from the RYDA website (www.ryda.org.au). The "Stopping distances" session involves a practical demonstration from a licensed driving instructor. By riding in the vehicle as passengers, or observing from the outside, students are able to experience or witness first hand the impact of speed, reaction time, and vehicle and road conditions. A session on hazard perception involves an interactive discussion about the most common causes of crashes for young people. In an effort to develop safe driving attitudes this session seeks to highlight what hazards they may face as drivers and provide strategies to avoid them. A similar session also involves an interactive discussion regarding the effects of drugs, alcohol, and fatigue on driving and helps students develop strategies to plan safe celebrations. A session included in programs conducted in New South Wales involves police officers presenting a video showing the tragedy of a young woman whose life is cut short on the night of her 18th birthday party due to a crash involving alcohol and speed. After viewing the video the police officer conducts an open discussion about the story and its themes. Another session involves advice regarding the financial aspects of car ownership including insurance, registration, and buying a vehicle. Finally, there is a session involving a crash survivor who tells their story of how the crash happened and the impact it has had on their lives and the lives of others. This session is intended to reinforce to the students that crashes do happen and that the consequences can be severe.

An evaluation of RYDA by Elkington (2005) uses self-reported information collected from 1,200 students pre- and post-program attendance with a final wave of collection for a three month follow-up. The primary aim of the evaluation was to assess the short- and long-term impact of the program on students' knowledge, attitudes, and behaviour. Elkington (2005) reports that RYDA was very effective at producing short-term gains in knowledge, however these gains were not maintained over the three month follow-up period if they were not reinforced. In fact the only message that was retained related to the BAC limit for learner and provisional licensed drivers. However, there was also an extensive advertising campaign targeting this issue at the time of the evaluation so it is unclear whether the retention of this knowledge was due to the program or other factors. The evaluation also failed to demonstrate long-term changes in self-reported behaviours as either drivers or passengers (Elkington, 2005).

It is important to note that at the time of writing this review the RYDA program had undergone some revision leading to changes to the content and delivery, which are expected to be implemented in 2010. Rigorous evaluation of this revised program is required before any comment regarding effectiveness and utility can be made.

4.6 Safety City (US)

The Safety City program is run by the Red Cross in Columbus, Ohio to teach kindergarten and elementary school children a number of safety behaviours (Luria, Smith, & Chapman, 2000). The focus for kindergarten children is on crossing the road, stranger avoidance, and dialling 911 in an emergency, while the elementary school program focuses on fire, electrical, and gun safety. Given the focus of this report only those aspects relevant to road safety will be discussed. The program for kindergarten involves a one-off 20 minute session involving a large group. Children practice crossing the road at a mock intersection complete with working traffic lights, crossing signals, and traffic (Luria et al., 2000). There is no additional training or education to supplement the program, however teachers and parents may reinforce the learning as a matter of course.

Evaluation of the program was based on data collected prior to the program and again at a six month follow-up. Schools participating in the program were randomly allocated to treatment or control groups. In all there were 144 controls and 122 treatment participants at the pre-test stage, and 91 controls and 90 treatment participants at the follow-up (Luria et al., 2000). Analysis of the data revealed that there were no significant differences in pre- and post-test knowledge for both groups, nor were there any significant differences observed between the scores of the two groups at either stage of the evaluation (Luria et al., 2000). As such the Safety City program appears largely ineffectual at teaching kindergarten children how to safely cross the road. However, it is possible that the evaluation materials were too abstract to adequately test children's knowledge (i.e., they may not have understood the questions). Other more successful programs teaching similar skills have involved lengthier training with multiple sessions, practice in the real world, and were targeted at older children (see discussion in section 8.5).

5 Driver training

Throughout the literature the terms *driver training* and *driver education* can be, and are quite often, used interchangeably. It is thus necessary to draw a distinction between the two before advancing this discussion of driver training further. According to Woolley (2000) *driver training* typically refers to a process involving the teaching of practical skills necessary to control or operate a vehicle. This includes aspects such as changing direction, accelerating, maintaining speed, and braking. *Driver education* on the other hand is a much broader term, which incorporates training, and is used in reference to all educational practices that focus on knowledge (e.g., of road laws, awareness), attitudinal (e.g., over-confidence) and behavioural (e.g., risk-taking) components, and also incorporates training. Driver education is also frequently used in reference to programs that involve in-car training in conjunction with classroom-based lessons. In the present context *driver training* will refer to educational activities that seek to equip drivers with specific skills (e.g., basic, defensive, and advance driving techniques, hazard recognition, etc.) through a practical regimen.

Driver training programs have been employed as a road safety measure by various jurisdictions internationally and locally for over 50 years (Christie, 2001; Langford, 2003; Woolley, 2000) and remain one of the most commonly proposed methods for combating novice drivers' involvement in crashes (Langford, 2003). Indeed, rising road tolls and highly publicised crashes involving young drivers are invariably followed by calls for compulsory or improved training for young drivers (Christie, 2001). One reason for the popularity of driver training amongst the general population is that it is an intuitively logical solution to a serious problem that is generally attributed to inexperience and lack of skill.

The effectiveness of driver training programs has been the subject of many reviews (e.g., Christie, 2001; Engstrom, Gregersen, Hernetkoski, Keskinen, & Nyberg, 2003; Vernick, Guohua, Ogaitis, MacKenzie, Baker, & Gielen, 1999; Woolley, 2000). Rather than revisiting an area that has been extensively addressed in the past a brief summary of key findings is provided. Evaluations of driver training programs from around the world have generally produced little evidence to suggest such programs are effective at reducing either the crash involvement or driving violations of those who undergo training compared to those who do not. A number of explanations have been offered for this lack of effectiveness, these are summarised below:

- Training can produce over-confidence in the individual's ability to both handle the car and manage hazardous incidents (Christie, 2001; Engerstrom et al., 2003; Woolley, 2000). For example, skid training in Scandinavian countries has proven singularly ineffective at reducing crash involvement (Langford, 2003).
- Motivation for training – individuals seek out training for different reasons. Those who seek out training so that they can pass a test to obtain their licence will have different outcomes to those who undertake training to enhance their safety on the road (Williams & Ferguson, 2004).
- Training programs typically have a short duration and focus largely on the acquisition of basic skills, as such any gains produced by the program may be over-ridden by other, more immediate influences, peers, for example (Christie, 2001; Langford, 2003; Williams & Ferguson, 2004).
- Training programs often lead to early licensing (Christie, 2001; Roberts & Kwan, 2008; Vernick et al., 1999). There are many suggestions that young people who experience driver training are more likely to get their licence earlier even if they have no need to drive regularly. For example, researchers have observed that when high school training was no longer available licensure rates amongst 16-17 year olds in Connecticut were reduced by around 75%

(Williams & Ferguson, 2004; Woolley, 2000). Early licensure increases overall driving exposure, which also leads to increased risk of crashing (Christie, 2001; Vernick et al., 1999).

- The deficiencies addressed by traditional driver training are not the only factors that have a role in crash causation (Langford, 2003; Woolley, 2000). Skills training does not target underlying personal values or motivations related to driving, and may also overlook other factors that contribute to young drivers' involvement in crashes, for example, optimism bias[4], risk perception, and over-confidence (Langford, 2003; Williams & Ferguson, 2004).
- Training may provide the skills for safer driving, however training does not always lead to behavioural change. It has also been demonstrated that training can instil young drivers with a sense of over-confidence and they may also drive with greater abandon (Christie, 2001; Langford, 2003).
- There is some possibility, however slight, that training is effective and that findings to the contrary may be the product of evaluation methods that are either poorly designed or implemented, or lack the sensitivity to register safety benefits (Langford, 2003).

It should also be noted that in reviewing the effectiveness of driver training programs many reviewers adopt strict search criteria in order to limit their analyses to the best evidence available. As such those programs most commonly reviewed are those where evaluations have been conducted that include particular outcome measures (e.g., use of official crash statistics) and randomly allocate participants to the treatment (i.e., receive training) or a control group. The implications of this are two-fold. First, there may be driver training programs that are effective that are not covered in reviews due to lack of sound evaluation methodologies, and second, current understanding of driver training as a road safety measure may be enhanced should such programs be subjected to more rigorous evaluations.

In light of the above information there are two interesting outcomes worth discussing with regard to the training of young drivers. The first is that despite the lack of evidence proving training programs create safer drivers training programs remain one of the most commonly cited solutions to the young driver problem amongst the general public and some politicians. Second, the lack of any real success of school-based driver training programs (see Woolley, 2000) has seen the decline of such programs (Senserrick, 2007; Woolley, 2000). This is certainly the case in Australia where the official licensing approach has shifted towards a process designed to increase driving experience under supervised conditions (Senserrick, 2007). Furthermore, the driver training described above pertains to programs designed to provide individuals with increasing levels of vehicle handling skills. Indeed, one of the key faults identified of such programs is their failure to address other skills necessary to become a safe driver. There is some indication that training that targets higher-order skills including risk and hazard perception, attitudes, and over-confidence may have the potential to greatly enhance road safety amongst young drivers.

The Goals for Driver Education (GDE) matrix (see Figure 5.1) is derived by combining a hierarchical organization of individual facets of the driving task with the key training areas that are targeted to improve competencies. The GDE was developed in the European context and is based on the driving task levels utilised in the GADGET (Guarding Automobile Drivers through Guidance, Education and Technology) project (Hatakka et al., 2003, cited in OECD, 2006). Examination of the matrix reveals that the lower levels of the matrix clearly related to driving ability and skill, typically lower order factors, whereas the top levels relate to more higher-order factors, such as attitudes, cognition, and

[4] Optimism bias is defined as a perceived invulnerability to certain events or dangers (Prabhaker, Lee, & Job, 1996). It essentially equates to a "that can't/won't happen to me" mentality, which may arise from a lack of understanding regarding the true nature of the risks involved.

psychosocial environment. Developers of the GDE matrix maintain that driver training should endeavour to cover as much of the matrix as possible, however current traditional approaches to training typically address only the lower left-most cells. To produce safer drivers, driver training also needs to address the higher levels as these are the factors that ultimately shape the driving situations in which the driver finds him or herself.

Figure 5.1
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

The AAMI/Skilled driver program (provided by AAMI, an insurance company) is not a school-based program but it is a good example of a driver training program that provides young drivers (18-25 year olds) with an insight into how to be a safe driver. Young drivers who complete the course receive discounted premiums on their car insurance. The course involves a theoretical and practical component (during which participants use their own cars) that demonstrates and reinforces safe following and stopping distances and how handling is effected by small increases in speed. Rather than teaching advanced vehicle handling skills the overarching aim of the program is to promote safety and deflate over-confidence (Senserrick, 2001).

An evaluation of this program utilising a control group for comparison found that individuals who attended the program were more likely to perceive themselves as better drivers than others their own age and reported increased confidence in their ability to handle hazards after receiving the training (it is possible that this is due to the program changing the way they drive – see below). However, participants did not rate themselves as better than most other drivers of any age and their confidence in general did not increase. Taken together these findings suggest that course participants believed that the training they received made them better than other young drivers because they had a greater awareness and understanding of the hazards of driving, and were thus better equipped to handle hazards when they arise and also to minimise risks when they drive. Results further indicated that for males confidence significantly decreased, while females confidence remained unchanged. Individuals who attended the program also reported significantly increased discomfort regarding closely following a vehicle during and after their participation in the program (Senserrick, 2001). It should be noted that the findings of this study were based on the self-reported behaviours and attitudes of the participants in the study. While they provide some evidence that the AAMI Skilled Drivers program appears to provide insight into driver limitations without producing over-confidence further evaluation addressing

issues of sample size and methodology, and incorporating some assessment of behaviour is desirable.

5.1 Safe Drive Test Drive: Young driver safety program

Safe Drive Test Drive is a defensive driving training program offered by the private driver training company Safe Drive Training (SDT). It is "a special one-day defensive driver awareness course aimed at young and novice drivers" (SDT, 2010) that provides specialised training in an off-road facility with a fleet of training vehicles and other training tools. The course employs a number of education techniques including multimedia lectures, demonstrations, and in-car driving experiences, which the providers claim will provide students with an understanding of the causes of crashes and how to avoid such situations. The in-car training also allows young drivers' to "not only practice how to get themselves out of these situations but how to avoid them occurring in the first place" (SDT, 2010).

The various modules included in the one-day course are intended to cover a broad range of road safety issues including vehicle maintenance (including tyres), attitudes and behaviour, driving styles (which cover reactive car control skills, wet weather driving, low risk/safe driving techniques, proactive driving, skid prevention and recovery, and vehicle stopping distances), and the causes of crashes - what they call the "Real Fatal 4" (SDT, 2010). The "real fatal 4" include overconfidence, risk-taking, inexperience, and peer influence, all of which are covered to some extent throughout the training course, however the majority of the program appears to focus predominantly on in-car training.

The *Safe Drive Test Drive* is currently offered to 650 schools throughout Queensland and New South Wales with a total of 4000 students from 143 schools participating in the program in 2009. In South Australia Safe Drive Training have recently made use of the new Tailem Bend motorsport complex, offering fleet training and the *Physics in motion* high school program. There is some indication that the Safe Drive Test Drive program may become available in South Australia, at least for limited periods, provided there is sufficient school interest in attending (SDT, 2010a). In 2010 a variation on the Safe Drive Test Drive program, the Youth Safe Driving Expo is being offered free to year 10 and 11 students as part of the Camco Group Motor Mania CQ motor show (SDT, 2010).

The effectiveness of the Safe Drive Test Drive program has not been evaluated. Given that driver training programs have proven ineffective in the past there remains some doubt as to the efficacy of the current program. The program itself purports to address risk factors including attitudes and behaviours, which if done adequately has the potential for positive gain, however a full and rigorous evaluation of this program in terms of achieving its stated aims and other road safety indicators is required.

5.2 Beginner Driver Education (BDE) curriculum (Canada)

In Ontario, Canada there has been a shift towards ensuring the quality of beginner driver education curricula meet high standards (W. Pollock, personal communication, June 17, 2010). The new standards developed by the Canadian Standards Association outline the minimum requirements for the design and delivery of the curriculum (e.g., the approach, structure, and minimum hours required), and the content of the curriculum (e.g., required topics, learning outcomes, etc). The new curriculum is intended to achieve the following road safety goals:

- Improve road safety for all road users;
- Improve the driving competency of beginner drivers;
- Develop respectful and responsible attitudes amongst beginner drivers;
- Enable beginner drivers to drive in a confident and safe manner.

Under the new curriculum guidelines BDE should include a minimum of 20 in-class hours and 10 hours of in-car training. A further 10 hours is to be devoted to further educational activities, which may be distributed flexibly according to the needs of the students and educators. Both the in-class and in-car educational components should adopt teaching and learning approaches that promote safety, promoting risk awareness, and the development of appropriate attitudes. The in-class education should also address road rules and the responsibilities attached to the use of a motor vehicle. The in-car component is intended to ensure that beginner drivers also develop the skills necessary to use the road safely with a primary focus on vehicle handling skills. In addition to teaching basic skills such as turning and parking a vehicle, the training component also teaches emergency control procedures such as skid control.

The first driver education curriculum to both meet and exceed these minimum standards, the JETALA Basic Driver Education Curriculum developed and distributed by Canadian PRO drivers Inc. was implemented in 2008. The course includes the use of interactive sessions that incorporate multimedia components (e.g., DVD footage) and up-to-date reference materials. The training component employs the use of knowledge-based scenarios to develop skills and also focuses on advanced hazard recognition within a cop-operative driving environment (Canadian Pro Drivers, 2010). While this education program exceeds the minimum standards outlined by the curriculum guidelines there has been no evaluation of this program in terms of knowledge gain, behaviour and attitude change, nor in terms of crash involvement or driving offences. While it is possible that a program incorporating education and training may have some benefit the lack of evaluation makes any comment regarding the efficacy of such a program difficult.

6 Curriculum-based or cross-curricula road safety education

Curriculum based and cross-curricula road safety education strategies involve the inclusion of road safety specific subjects within the curriculum, or incorporate road safety themes within existing subjects. Throughout Australian schools there is recognition of the importance of teaching road safety and provisions are made for including such lessons within current curriculum. There are also a growing number of resources and professional development opportunities available to teachers to supplement the provision of road safety education in schools.

Road safety is not uniformly included within curriculum. Some schools include it in health and/or physical education studies, some include it within social studies streams, while others offer road safety programs as elective classes. A number of Australian states have also taken steps to include in-school road safety education as part of the licensing process. This can be observed in the ACT and WA road safety education programs Road Ready and Keys for Life, which are discussed further below.

6.1 Skills for Preventing Injury in Youth (SPIY)

Skills for Preventing Injury in Youth (SPIY) is a school-based intervention program based on psychological theories (e.g., the Theory of Planned Behaviour; see Buckley, Sheehan, & Shochet, 2010) that is designed to utilise cognitive-behavioural strategies to reduce the prevalence of risk taking and associated injury amongst adolescents (Buckley, Sheehan, & Shochet, 2010). The primary goals of the program are to increase protective behaviours towards risk-taking peers, decrease adolescent risk taking behaviours, and to increase skills in first aid (Buckley et al., 2010). SPIY is incorporated into the Year 9 Health Studies curriculum in schools from a low socio-economic region in Southeast Queensland. Each lesson involves the use of a risk taking and injury scenario followed by an introduction to the first aid necessary to treat the injury, and cognitive-behavioural strategies for avoiding the risk taking behaviour; lessons are conducted in such a way that it allows students to practice the skills learnt (Buckley et al., 2010). While the program covers a number of risk taking behaviours over the course of the eight lessons, there are four lessons that also have a road safety focus. These lessons involve scenarios about riding in a car with an underage driver, riding in a car with a drunk driver, riding a bicycle dangerously on the road, and riding a motorcycle off-road (Buckley, 2008). These represent some of the most salient road safety issues for the target audience (Year 9 students are typically aged around 14 years old), which is reinforced by the fact that the scenarios utilised in the lessons were developed using focus groups of similarly-aged students (Buckley, 2008).

Buckley and colleagues (Buckley et al., 2010) undertook a preliminary evaluation of the program in order to gauge the short-term effects of the program on risk taking behaviour. The evaluation process utilised an intervention and a control group to gather self-reported data on risk taking behaviours (using a 14 item scale to determine involvement in certain behaviours in the past 3 months, responses scored as “yes” or “no”) at baseline (one week prior to the commencement of the program) and at follow-up 3 months later. In all there were 360 students in the intervention group and 180 students in the control group at baseline, with 327 from the intervention and 151 from the control group completing the follow-up surveys. A number of focus groups were also conducted to obtain qualitative data regarding students’ perceived behavioural change following completion of the program. Analysis of the survey data suggested that there was a decline in self-reported risk taking behaviour for students who participated in the program, while their counterparts in the control group demonstrated an increase in self-reported risk taking. The change in self-reported risk taking scores was significantly different for both groups with program participants demonstrating a significantly larger positive change (i.e., reduction in self-reported risk taking) compared to the control group (Buckley et al., 2010).

The evaluation of the SPIY program made use of a self-report instrument assessing involvement in risk taking behaviours over the previous three months; a number of items in this instrument are related to road user behaviours. As such the above research offers some indication that SPIY has a positive effect on road safety outcomes for this age group. However, the evaluation itself is only preliminary and concerned with the short-term outcomes of the program. While it appears that the program has some utility in addressing risk taking behaviours in general further evaluation of the long-term effects, including a more detailed examination of road safety behaviour, is necessary before any definitive response can be made.

6.2 School Drug Education and Road Aware (SDERA)

School Drug Education and Road Aware (SDERA) forms the foundation of the West Australia State Government's strategy for preventing the harms and injuries related to substance use and road trauma. It provides WA schools with resources for teaching drug and road safety education within the curriculum, producing a range of resources under these two streams that can be used with children in kindergarten through to Year 12 students, as seen in Table 6.1 (D. Zines, personal communication, May 10, 2010). Given the focus of the present review discussion will focus on the resources relevant to road safety.

Table 6.1
SDERA road safety resources

Resource	Target group
Challenges and choices:	
Early childhood	Kindergarten – Year 3
Middle childhood	Years 4-7
Early adolescent	Years 7-10
Keys for life – pre-driver education	Years 10-12
Licensed to Drive	Years 10-12

As part of an initial trial SDERA has been implemented in 25 schools throughout Western Australia. A qualitative evaluation of SDERA is ongoing; baseline data has been collected from a number of cohorts (years 4-7 and 8-10), including comparison students recruited from South Australia, with the post-test data scheduled for collection during Term 4 2010 (SDERA, 2010).

6.2.1 Challenges and choices

Challenges and Choices is a series of three drug and road safety educational resources designed for Kindergarten - Year 10 students. Each version focuses on building resilience and providing educational material that is relevant to the developmental stage of each group. The road safety material, for example, focuses on pedestrian and passenger issues as these are the road using behaviours and experiences most salient to this age group. The following information is derived from the Challenges and Choices resource information which can be downloaded in PDF from the SDERA website at http://www.det.wa.edu.au/sdera/detcms/navigation/for-schools/resources/challenges-and-choices/.

Early Childhood (Kindergarten - Year 3)

The key focus areas at the early childhood stage are on passenger and pedestrian safety, playing safely, and sensing traffic. With regard to passenger safety children are taught safety aspects of being a passenger, including wearing restraints, entering and exiting a vehicle safely, and being a safe passenger in general. Pedestrian safety focuses on safety strategies for crossing the road, including

holding an adult's hand, selecting safe places to cross, and systematic search strategies for crossing the road. Playing safely deals with riding bicycles and other wheeled devices (e.g., skateboards) and also playing in safer areas (i.e., away from roads). Finally, the sensing traffic area focuses on recognising traffic sounds, road signs, and traffic signals and road markings. This area also focuses on increasing pedestrian visibility in near-traffic environments.

Middle Childhood (Years 4-7)

Challenges and choices in middle childhood focuses further on practical safety issues for young road users. This stage extends on the early childhood factors addressing passenger and pedestrian safety, safety on wheels, and recognising and understanding road rules and signs. At this stage passenger safety extends on the earlier learning regarding the use of restraints and safe entry and exit from vehicles to include the safe use of public transport, and also how to make journeys safer as a passenger by reducing driver distraction. Pedestrian safety knowledge is expanded to encompass road crossing in a variety of situations, incorporating systematic searching strategies to avoid traffic, and understanding other risks to pedestrians such as driveways and walking with adult supervision. The safety on wheels component also focuses on safe bicycle (and other wheeled devices) usage including safety equipment and appropriate sized bicycles. The final area focuses on understanding the road rules, and also understanding road signs and signals.

Early Adolescence (Years 7-10)

Challenges and choices for the early adolescent sees road safety education shift towards more abstract concepts and seek to shape attitudes and behaviours that are favourable to road safety. There are five key areas in this stage focussing on road safety facts, the causes of crashes, the consequences of crashes, reducing risks for road users, and the laws that apply to road users.

- The facts of road safety: This area focuses on safety issues for young road users and addresses young road users involvement in crashes as passengers, pedestrians, and other vulnerable road users (motorcyclists and bicyclists). Crash statistics are used to reinforce the issues addressed in this area.
- Why crashes happen: This area identifies and addresses factors implicated in the causation of crashes. There is a focus on how the interaction between decisions and actions within the traffic environment may result in a crash. The characteristics of young people (e.g., risk taking and overconfidence) and how these may increase the risk of crashing. This topic also covers other areas including speed, fatigue, restraint use, drink driving, reaction times, stopping distances, and peripheral vision.
- Reducing road user risk: This area focuses on road safety technologies (active and passive) in vehicles, how it works, and its effectiveness at reducing injuries to road users. This area also includes discussion about vehicle safety ratings.
- Consequences of crashes: The focus of this area is on the range of consequences arising from a crash, including physical, emotional, social, financial, and legal. Students are also encouraged to consider strategies to reduce risks to road users in a range of situations.
- Road users and the law: Focus on the road rules and laws applicable to road users and also address community expectations regarding safety for all road users.

6.2.2 Keys for Life

The Keys for Life is a pre-driver program available to 15-16 year old high school students. The program provides resources and specialised training for teachers delivering the course, which they then deliver in school over a number of sessions totalling at least 10 hours. The Keys for Life program

can also count towards the WACE (Western Australian Certificate of Education) when the program length meets the minimum criteria of 18 hours, which includes both in school and at-home hours. The main aim of the program is to develop the knowledge, skills, and attitudes necessary for young people to become safer drivers, including encouraging extensive hours of driving practice. As part of the program students are also able to start the Learner's Permit application process, which includes sitting the Learner's Permit theory test in school (as opposed to a licensing venue). Successfully completing the program rewards students with a certificate, which can be redeemed for a Learner's Permit, and also entitles the student to a financial discount towards the Learner's Permit fee.

At the time of writing there was no evaluation of this program available, however one is planned. One of the primary concerns is that by enabling young students to sit the Learner's Permit test this program may well encourage early licensure amongst those who participate.

6.2.3 Licensed to Drive

Licensed to Drive is designed to be delivered as part of the Western Australian Curriculum Council's Health Studies Course, as such it effectively embeds road safety education within school curriculum. Licensed to Drive provides a number of support materials that place the content and outcomes of the Health Studies curriculum in a road safety context. Licensed to Drive also offers teachers the opportunity to deliver the Keys for Life (see above) program within the Health Studies stream. More information regarding Licensed to Drive can be obtained from the SDERA website at http://www.det.wa.edu.au/sdera/detcms/navigation/for-schools/resources/licensed-to-drive/.

No evaluation is currently available, nor is one planned. However, as the program provides the opportunity to include the Keys for Life within the curriculum it also raises concerns regarding the early licensure of young drivers.

6.3 Road Ready

Road Ready is the Australian Capital Territory's approach to road safety education and the licensing process introduced into the curriculum for year 10 students in the year 2000 (Wundke, Ampt, & Riddell, 2004). Anyone wanting to obtain a Learner's Permit in the ACT must complete the Road Ready either in school, or at specialised Road Ready centres for school leavers. The main aim of Road Ready is to increase safe driving practices among young novice drivers. In order to achieve this Road Ready seeks to implement and encourage early learning of the risks and hazards encountered within the driving environment, encourage gaining as much driving experience as possible under the safest conditions possible, and to raise awareness of the complexities of driving (Di Pietro, 2003). The program consists of 13 modules covering a variety of subjects including crash causation, risk taking and hazard awareness, substance use, and the road rules. The classroom program incorporates a number of learning strategies including research activity, statistical analysis, problem solving, and group activities to address the key issues of each topic (Di Pietro, 2003). Road Ready forms part of the ACT licensing system whereby upon successful completion[5] students have earned their Learner's permit, however the Road Ready philosophy extends beyond obtaining the licence and encourages young people to undertake extensive driving practice with their parents, carers, or licensed instructors (Di Pietro, 2003).

As part of its implementation Road Ready was subjected to evaluation, which commenced in 2000 with control group data obtained from a number of drivers obtaining their provisional licence prior to

[5] Successful completion of Road Ready requires students to attend a minimum 80% of classes, active participation, the completion of two assessment items, and the road rules knowledge test.

the programs commencement. A final wave of data, including self-report and official data was collected from Road Ready participants during 2002-2003. The evaluation sought to ascertain the program's effectiveness at improving road safety by comparing the histories of pre-Road Ready novice drivers to Road Ready graduates on three key outcomes: the amount of driving experience to which new drivers were exposed, young driver's involvement in crashes, and the number of driving infringements recorded by young drivers (Wundke et al., 2004).

Length of time on Learner's permit

The self-report data suggested that the majority of Road Ready participants reported staying on their Learner's Permit an average of six months longer than control group members. Furthermore, 50% of Road Ready participants report spending more than 50 hours on practice compared to around 30% of control group members, which Wundke and colleagues (2004) suggest is a significant improvement. However, as one of the primary aims of the Road Ready program is to increase the amount of driving experience for learner drivers it apparently achieves this for only half of all students who complete the program. As the evaluation data is now six years old it is possible that this trend could have improved or declined in the interim.

Contrary to the above findings, records obtained from all drivers who obtained their licence in the period August 1996 to July 2003 suggest that the average length of time spent on a Learner's Permit is declining since the implementation of the Road Ready program. For example, since Road Ready was made compulsory in the year 2000 full data regarding licensing rates is available for periods between August and July 2001-2002 and 2002-2003. Learner Permits issued in the 2001-02 period were held for an average time of 411 days, while Learner Permits issued during the 2002-03 period were held for an average of 264 days.

Infringements

Based on the self-reported driving infringements both groups reported similar rates of receiving a fine (approx 20% from both groups), although differences were observed in the type of infringements for which each group were fined. Control group participants were more likely to be fined for driving infringements (e.g., speeding) than Road Ready participants, which the evaluators interpret as proof that Road Ready has had an impact on infringement types that are more dangerous (Wundke et al., 2004). Further differences between the two groups were observed in the frequency of demerit points with control group members reporting a loss of 0.63 points per person, per year of driving, compared to 0.24 points for Road Ready participants.

Official statistics regarding driving infringements showed that rates of driving infringements generally declined after the introduction of the Road Ready program for both Learner and Provisional drivers (Wundke et al., 2004). These statistics also showed that infringement rates are higher for young drivers on their Provisional licence than those on their Learner's permit. Comparison of control group subjects to Road Ready graduates suggests that there are higher levels of infringement amongst the control group – 1.96 per person compared to 1.15 per person for Road Ready participants. This was also observed when both groups were compared on infringement rates in the first two years of driving (Wundke et al., 2004).

Crash involvement

Involvement in crashes produced some interesting findings. According to Wundke and colleagues (2004) the average number of crashes per person, per year of driving was reported to be higher by Road Ready participants than the control group, 0.5 versus 0.31 crashes per year respectively. This discrepancy may have been the product of the nature of the data such that crash involvement for the

control group was based on official statistics, which would not include crashes not reported to police, while the self-reported data of Road Ready participants may have included such crashes (Wundke et al., 2004).

Again, the use of official crash statistics appears to demonstrate a downward trend in crash involvement after the introduction of Road Ready (Wundke et al., 2004). Furthermore, comparison of official crash statistics for the control and Road Ready groups show slightly lower levels of crash involvement for the Road Ready group. It should be noted that the relatively infrequent occurrence of crashes makes any real analysis of trends difficult.

General Comments

The results of Wundke and colleagues' (2004) evaluation of the Road Ready program are somewhat equivocal with regard to the program's effectiveness. The reported findings are contradictory in some areas, which further cloud the issue. Furthermore, the failure to investigate any meaningful statistically significant differences or change, or at least report the findings of these, limits any interpretation of the results beyond the identification of slight trends.

A final aspect of the Road Ready program that needs to be addressed is that there is some evidence that licensure rates have increased since the program's implementation. As has been discussed previously, early licensure leads to increased driving exposure, which also increases the risk of young drivers being involved in crashes (Christie, 2001; Vernick et al., 1999).

6.4 Your Turn: Road safety choices for middle years

Your Turn: Road safety choices for middle years was developed by Transport SA and the Department of Education and Children's Services (DECS) to provide South Australian teachers a resource for teaching road safety to students in years 6-9 (Hazel, 2004). *Your turn* is not placed specifically within the school curriculum, rather it encourages an integrative approach through all areas of the South Australian Curriculum, Standards and Accountability (SACSA) framework including, for example, subjects such as Arts, Design and Technology, Maths and Science, and English (Hazel, 2004). *Your Turn* is intended to provide an educational resource that allows schools and teachers to implement road safety education that meets the unique requirements of the students. *Your Turn* provides a series of 15 topics that are spread over 5 units and comprise a variety of learning activities that teachers are encouraged to adapt in order to provide road safety education that is most suited to the needs and interests of the students. The teaching and learning outcomes of each unit or topic are aligned with the SACSA Framework, ensuring that *Your Turn* also meets the educational requirements outlined by the curriculum (Hazel, 2004).

As mentioned above, *Your Turn* comprises five units, each of which focuses on a different aspect of road safety that is relevant to road users of the target groups (years 6-9). The focus and objectives of each unit are outlined below. The objective of Unit one is to raise students' awareness and understanding of the risks that face road users. The unit also seeks to improve students' ability to identify risks that may arise in various situations and to demonstrate how an individual's response can moderate the subsequent effects of the risk. The primary aim of Unit two is to address the relationship between road users and vehicles. It seeks to highlight factors that influence the performance of both the individual and the vehicle, and also demonstrate how some circumstances can be controlled while others cannot. Unit three seeks to address issues surrounding crashes and crash causation. This unit concentrates on understanding the terminology used to discuss crashes (e.g., fatality, accident, crash, incident, etc.) and encourages the use of statistics to identify groups that are most at risk of being involved in a crash. Another key objective of this unit is to reinforce that crashes arise from definite

causes that can be avoided (i.e., crashes need not happen). Unit four seeks to highlight the responsibilities of road users and extends this to being a safe road user. This unit also seeks to identify strategies the individual can employ to enhance safety for themselves, and also addresses the role of technology (both in-car and road infrastructure) in road safety. Finally, Unit five seeks to place road safety as a community issue with shared responsibilities. It also encourages students to consider ways to deliver road safety messages to the broader community, and, in so doing, give students a personal investment and sense of ownership in the issue.

Your Turn has not been evaluated so no comment can be made with regard to its influence on road safety. Furthermore, at the time of writing this report the *Your Turn* resource was currently undergoing a process of revision.

6.5 The Birdwood High School experience

An example of a curriculum-based approach to RSE is that adopted by Birdwood High School in the Adelaide Hills. Due to growing concerns amongst the school and local communities regarding the deaths of present and former students on local roads the Birdwood High School appointed a Road Safety Project Officer to develop, implement, and promote road safety via the inclusion of road safety elements in mainstream curriculum subjects for Year 8-12 students. Additionally, a Driver Education elective subject has been introduced into Year 11 to promote “skills, knowledge and attitudes necessary for safe, responsible motoring in the Adelaide Hills”. Theory work is provided in addition to more hands-on activites (e.g., attendance at a mock crash scene) and an optional driver awareness practical course for students with a Provisional Driver’s Licence (which is provided at extra cost).

7 Multi-modal approaches to road safety education

Multi-modal approaches to road safety education supplement education with other strategies. For example, engineering enhancements to school crossings and other infrastructure near schools make the road environment safer while education may further entail instructing students on the use of such facilities. Other programs may incorporate road safety as part of safe travel strategies or strategies that encourage more environmentally friendly forms of travel. Such programs may encourage students to walk or cycle to school, and as such schools need to be sure that students are able to do so safely. An example of a road safety education program that incorporates each of these elements is South Australia's Way2Go program.

7.1 Way2Go

Way2Go is based on the philosophy that safe and sustainable travel is crucial for the survival of the planet. The program recognises that encouraging safer, greener, and more active travel amongst South Australian school children requires a whole community approach to education that includes schools, councils, and community groups (DTEI, 2010). Each of these groups plays a unique role in the Way2Go strategy.

Schools

Schools are responsible for providing young people with the knowledge and skills to understand the issues of road safety and environmental sustainability. To facilitate this the Department for Transport, Energy and Infrastructure (DTEI) has developed resource materials for use in South Australian schools (Hazel, 2009). The *Way2Go* resource itself consists of three kits providing age-appropriate resources for students in Early Years (Reception – Year 1), Primary Years (Years 3-5), and Middle Years (Years 6-7). *Way2Go* is designed to be incorporated into the curriculum through the areas of Health, Physical Education, and Society and Environment, and as such meets the standards for teaching and learning outlined by the South Australian Curriculum, Standards and Accountability (SACSA) framework (Hazel, 2009).

Way2Go in the Early Years concentrates on aspects of pedestrian, passenger, and cycling safety and also covers issues of play safety in road environments. Public transport and other travel options are also introduced at this stage. The Primary Years resource recognises that children of this age may already be travelling independently on public transport and concentrates more on increasing primary-aged students' awareness of roads and their responsibility to use it safely. Students also explore the benefits of utilising alternate means of transport from a variety of perspectives. The Middle Years resource recognises that students of this age are active road users as pedestrians, passengers, and cyclists. The Middle Years resource also seeks to explore attitudes towards motor vehicles by examining the social, environmental, cultural, and lifestyle impacts of motorised transport. Students are also encouraged to consider how to reduce society's dependence on the car as a means of transport, and the implications of this. The *Way2Go* resources also contain interactive materials, such as DVDs and CDs, that can be incorporated within lesson plans; the Early Years resource also contains a number of picture books that address road safety issues such as seat belt use, etc.

Bike Ed

Another resource available to students aged 9-13 years in the Way2Go program is the Bike Ed program (DTEI, 2010). *Bike Ed* provides bicycle education and training to students that covers bicycle handling skills, road rules, and traffic skills (DTEI, 2010). Bike Ed seeks to improve students' awareness of road safety and develop the skills and attitudes necessary for safe cycling in traffic

environments. The practical sessions also seek to develop students' understanding of the consequences of their behaviour while they are on the road. The program is delivered in schools by trained facilitators over a period of seven sessions of 1.5 hours duration, which are usually conducted weekly, making for a total of 10.5 hours of education. *Bike Ed* was developed, and is provided by Bicycle SA. While the South Australian Bike Ed program has not been evaluated, a similar program in use in Victoria was evaluated in the latter half of the 1990s. Carlin, Taylor, and Nolan (1998) compared interview data from 148 children who had received hospital treatment for an injury sustained in a bicycle accident and 130 matched controls. Data related to their completion of the Bike Ed program (which was also partially verified by checking school involvement in the program) and the nature of the accident and how it occurred. Between groups comparisons revealed that rather than serving as a protective factor, experience of the Bike Ed program actually increased the risk of experiencing a bicycle related injury. It should be noted that amongst the injured sample only 13% of injuries were sustained in collisions with a motor vehicle while the vast majority (63%) were bike only incidents (Carlin et al., 1998). It is worth keeping in mind that this evaluation was conducted over 10 years ago, as such it is possible that the program has since been modified; it is difficult to comment on similarities between the current model used in South Australia and this early version from Victoria.

A number of evaluations of bicycle education programs from around the world have produced similar findings to those from Victoria. Colwell and Culverwell (2002) sought to determine the effectiveness of bicycle training using self-report information from 336 (232 boys, 103 girls) English school students aged 13-16 years (M = 14.78, SD = 0.49). Around 46% of the sample indicated that they had attended a national bicycle training program in the past. Students provided information regarding their involvement in bicycle related accidents, their riding behaviour, and also safe riding attitudes. In order to determine the effectiveness of the program participants who indicated they had a history of at least one cycling accident were compared to those who had not. The results of this analysis revealed that the training program had no significant relationship with accident involvement, nor did it influence safe riding behaviour or attitudes, although participants in the "accident" group self-reported significantly fewer safe riding behaviours than their counterparts. While these findings suggest that training has little benefits for safe road use this study is limited by a number of factors. First, the data was based on self-report information which may be subject to bias such that behaviours and attitudes are either over- or under-represented by participants – there was no control for socially desirable responding. Further, participants had undertaken the training program an average of four years prior to this evaluation, making it difficult to attribute the training to present behaviour. These findings further indicate that *if* training has short-term gains these may be lost when children enter adolescence.

A US study assessing the road safety benefits of bicycle training for students in grades 1-3 found that the training had a lasting effect on knowledge (Nagel, Hankenhof, Kimmel, & Saxe, 2003). The design of this study involved collecting pre-test data immediately prior to the students attendance at the bicycle safety presentation, with post-tests conducted immediately after and at a one-month follow-up. A quiz consisting of 11 yes-no questions was used to assess knowledge at each time-point. Students were awarded one point for correct answers so knowledge scores could range from 0 to 11. Analysis of the data revealed that students demonstrated significantly improved bicycle safety knowledge in a number of areas (e.g., helmet wearing and some limited traffic awareness), which were also retained at the one-month follow-up. According to the authors this represents the retention of knowledge over a significant length of time, however further follow-ups after longer latency periods would be required to support this contention. Although the study demonstrates some improvement in knowledge there was no assessment of actual behaviour. Studies in other areas have shown that improvements in children's road safety knowledge are not necessarily reflected in their behaviour as road users (for example, see Zeedyk et al's., 2001 assessment of road crossing behaviour in Section 5.5). Should such training programs improve road safety knowledge perhaps some supplemental education is required to ensure the transference of this knowledge into behaviour.

Councils

Councils involvement in the *Way2Go* program is to provide a safe travelling environment to and from school. Councils develop engineering works plans and seek to improve current infrastructure such as footpaths and school crossings in order to encourage walking or cycling to and from school. Councils work closely with the schools involved to identify travel routes that require attention (DTEI, 2010).

Community groups

Way2Go also encourages involvement from a number of community groups and government agencies, including the Department of Health and the Department of Education and Children's Services (DECS), and other local organisations or community groups, for example, community road safety groups (DTEI, 2010).

Evaluation

While *Way2Go* itself has not been the subject of evaluation, one of the programs from which it is derived – Safe Routes To School (SRTS) – has. SRTS was a program implemented by the then Transport SA (now DTEI) that sought to improve the safety of children travelling to and from school. The South Australian model was based largely on an identical program implemented in Victoria, however the two programs differed in two key areas: SRTS in South Australia included consideration of environmental and health issues and did not include an enforcement aspect, while the Victorian program did include a significant enforcement aspect and focussed mainly on the issue of road safety (Couch, McCutcheon, & Cirocco, 2001). Implementation of the program within schools involved the identification of risk factors confronting pedestrians and cyclists in that area and developing an integrated engineering and educational approach to improve road safety (Couch, et al., 2001). Given the multi-modal approach of this program efficacy of both the educational and engineering components must be considered in any evaluation of its effectiveness.

A process evaluation of South Australia's SRTS program has been conducted with the evaluation addressing issues regarding the programs implementation and the perceptions of the program amongst key stakeholders. As such the findings of this evaluation provide little in the way of quantifiable evidence regarding the effectiveness of the program, however preliminary findings suggest that most schools involved in SRTS reported improvements in the management of traffic around schools in a manner that lowered concerns about road safety (Couch et al., 2001). Fortunately, evaluations of Victoria's experience of SRTS are available that focus on knowledge, behaviour, and crash-related outcomes of the program. Cairney (2003) compared students from SRTS schools to students from non-SRTS schools in order to examine the impact of SRTS on students' road safety knowledge and the road safety behaviours of students and parents outside of schools during drop-off and pick-up times. Cairney found that the extent of road safety education was comparable across school types (SRTS vs non-SRTS); the road safety quiz utilised in the evaluation failed to produce any difference between students from both types of school.

Observations of road using behaviour outside of schools produced interesting findings. Students from SRTS schools were more likely to use school crossings and employ appropriate crossing procedures (look left, look right, look left), 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. SRTS students were more likely to wear bicycle helmets correctly than their non-SRTS counterparts, although the actual number of cyclists correctly wearing helmets was quite small. Furthermore, parking during the morning periods was more orderly at the SRTS schools, however there were no differences observed between schools during the afternoon periods (Cairney, 2003).

An outcome evaluation of the Victorian SRTS program sought to determine the effect of the program through an examination of crash statistics (Delaney, Newstead, & Corben, 2004). This evaluation employed before and after assessments of SRTS schools and used data from non-SRTS schools as a control sample. The findings indicated that SRTS had a positive impact on road safety with the largest improvements observed with regard to reductions in crashes during school travel times that involved primary school aged pedestrians and cyclists, which were reduced by 17.9%. A further 4.8% reduction in crashes involving all road users during school travel times was also observed (Delaney et al., 2004).

Taken together the above findings suggest that road safety strategies that combine education with engineering improvements are an effective means to improve road safety *near schools*. However, the lack of any real advantage in terms of improving road safety knowledge and behaviour is concerning. It appears that such programs may have a limited effect on road safety behaviour beyond the immediate surrounds of the school, an evaluation of the impact of SRTS on road safety in non-school surroundings would be necessary to confirm this.

7.2 Speak Out! (Norway)

In an effort to reduce the number of crash-related injuries amongst adolescents aged 16-19 the *Speak Out!* program was implemented as a means of stimulating stronger social controls over driving amongst this group (Elvik, 2000). This program encourages the passengers of teenage drivers to speak out against their unsafe driving practices. The program involves an information component, and an enforcement component. The information component is delivered in schools via video and oral presentations, and a variety promotional materials consisting of T-shirts, hats, key rings, and playing cards (Elvik, 2000). An enforcement component targeting behaviours such as speed and drink driving was also carried out by uniformed police officers during times when teenagers do most of their driving (i.e., weekends), as it was believed that not all passengers will speak out and not all drivers will listen to those who do (Elvik, 2000). *Speak Out!* was initially implemented in the Norwegian county of Sogn og Fjordane and has since been adopted nationally.

An evaluation was conducted by Elvik (2000) to determine the effect of *Speak Out!* on the crash-injury rates amongst adolescent drivers and passengers. As the program was specifically targeted at passengers the primary indicator of success was taken to be a reduction in injury rates amongst teenaged passengers. In order to assess this the evaluation compared crash injury statistics five years prior to the implementation of the program (1987-1992) to three time periods after the program began (1993-1998, 1994-1998, and 1995-1998), which served as a means to compare the program at various levels of activity. Crash injury statistics for the Sogn og Fjordane county were compared to the neighbouring county of Møre og Romsdal as a further control. Analysis revealed that the number of teenagers injured in crashes in Sogn og Fjordane were significantly reduced with further comparisons revealing that the largest reductions were observed for passengers while no significant change was observed for drivers. A multivariate analysis controlling for the effects of potentially confounding variables (e.g., changes in traffic volume and density, percentage of teenagers in population, and trends in injury rates) revealed that the reduction of teenage crash injury rates attributed to *Speak Out!* was significant for car passengers but not for drivers.

Elvik (2000) argues that as the group primarily targeted by the program is passengers reductions in crash injuries observed in this group are taken to suggest that *Speak Out!* fulfils its intended aim. There are, however, limitations with the study's methodology that should be mentioned. First, the study is predicated on the use of crash statistics alone, which, as has been discussed, are fraught with a number of potential confounders. Within the present study there is no apparent effort made to determine actual exposure to *Speak Out!* other than a blanket assumption that all teenagers aged 16-19 years in Sogn og Fjordane had attended the presentation. The data do not allow an assessment of

the program's influence on individual behaviour. Furthermore, given that the program involved an enforcement component the study has failed to make clear whether reductions in crash injury rates are the result of the information disseminated, or the product of enforcement practices. Further assessment of these issues would be beneficial.

8 Methods of delivery

While program evaluations typically assess a program as a whole, examinations of the program's individual components can provide some insight into why a program may succeed or fail to achieve the desired outcome. Examining issues regarding the delivery of educational messages (e.g., guest speakers, mock crashes, and interactive exhibits) provides some indication of what does or does not work. To this end, the following section draws upon literature examining methods of delivery pertinent to the field of road safety education in order to facilitate an understanding of the benefits and limitations of these approaches.

8.1 Guest speakers

A commonly utilised education tool is the delivery of road safety information by guest speakers, such as uniformed police officers in the YDEP, fire fighters in the RAAP program, road safety professionals and individuals involved in a serious crash included in the Youth and Road Trauma Forum and the Street Smart Programs. Generally speaking guest speakers are employed as they possess knowledge of the issue usually arising from their own personal experiences, be it as a member of the emergency services that frequently respond to crashes, or an individual who has suffered severe injury from involvement in a crash.

A key aspect of attitude change that has long been recognised by marketing researchers and practitioners is that the credibility of the source of the information plays a key role. Source credibility refers to the trustworthiness and expertise attributed to the source of a message by its recipients (Tormala & Clarkson, 2007). 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). A recent study by Tormala, Briñol, and Petty (2006) confirms these findings, however when they examined the relationship between source credibility and the strength of the argument (based on evidence contained within the argument) they found that a highly credible source combined with a strong argument produces more favourable attitudes (to the object of the argument), yet when the highly credible source is paired with a weak argument the inverse is observed, with less favourable attitudes produced towards the object of the argument.

There are a number of approaches to RSE that involve delivery of information from police officers, YDEP for example. This poses an interesting conundrum with regard to source credibility for adolescent audiences. A recent evaluation of adolescent perceptions of police instructors in a substance abuse prevention program by Hammond and colleagues (Hammond, Sloboda, Tonkin, Stephens, Teasdale, Grey, et al., 2008) produced mixed findings. This research found that in general early adolescents (students in years 7-9) viewed police presenters more favourably than non-police presenters. However, individuals who were involved in deviant behaviour tended to have more negative attitudes towards police officer instructors. A number of explanations for these findings are possible. Students who have had previous positive exposure to police officers through other programs were found to have more favourable attitudes towards police officers than those who had no previous exposure. Similarly, students reporting active involvement in deviant activity may have a fear of police detection, or have previously experienced negative interactions with police (i.e., they got caught) (Hammond et al., 2008). These findings have a number of implications for programs such as YDEP. First, it appears that the use of well trained police officers is appropriate for road safety programs, however this may be tempered by the negative attitudes of adolescents towards police. This may be particularly salient amongst adolescents of driving age who may feel targeted by police, or develop attitudes vicariously from peers who have had negative experiences. Such influences may be

countered by increasing positive exposure to police officers (e.g., increasing exposure across by delivering programs over multiple sessions) and providing opportunities to improve public relations in general.

The evidence suggests that guest speakers have the potential to have some impact (the magnitude of this impact with regard to road safety education is yet to be adequately quantified) on the effectiveness road safety education, however such programs should be approached with caution and need to be developed using evidence-based and best-practice approaches to their content and delivery. This can be observed in the work of Deans and Nisbet (2003) who found that outcomes of a safety presentation by a wheelchair presenter were vastly improved by adopting a number of changes, key among which was the shift in the focus of content away from the presenters personal story to more specific topics addressing risk. It would appear that the effectiveness of guest speakers at delivering road safety messages is dependent on what that message is and how it is delivered. Presentations focussing on the personal experiences of the presenter may have the potential to hinder, rather than promote, road safety messages.

8.2 Drama as an educational tool

Mock crash scenes make use of emergency personnel and actors to demonstrate the tragedy and consequences of a crash, and provide a sense of realism that cannot be achieved through other means (e.g., video or still images). As such mock crashes have become a popular tool in road safety education, as evinced by their inclusion in both the Youth and Road Trauma Forum and Street Smart programs. Due to their theatrical approach there may be value in comparing mock crash scenes with other drama-infused programs.

One such program from the UK seeks to educate students about the dangers of drink driving through a dramatic production called “Too much punch for Judy” (Powney, Glissov, & Hall, 1995). The effectiveness of this program was assessed in comparison to two other educational programs, one delivered in class by a police road safety officer, and another delivered in class by a teacher. Attitudes and learning were assessed before and after the performance, with a second follow-up conducted three months later in order to assess the programs affect on long-term learning. Of the three programs, students (and teachers) who attended the dramatic production rated this experience more favourably, followed by the police road safety officer visit, with the teacher presentation as the least enjoyed experience. However, assessment of the dramatic production as an educational medium suggest that general changes in knowledge (both short- and long-term) achieved by the program were just as likely in the other presentation formats. Furthermore, the nature of the sample in the study was such that assessment of behaviour change with regard to drink driving was restricted to one item determining if participants had accepted a lift from someone who had been drinking. The limited evidence regarding this proved equivocal providing little evidence of significant behaviour change as a product of either of the programs included in the evaluation.

Although the dramatic presentation was not found to be significantly more effective than the police officer or teacher presentations, the work of Powney, Glissov, and Hall (1995) suggests the value of such approaches lie elsewhere. For example, they found that the dramatic production was the most favourably rated of the three and was highly regarded for its ability to stimulate, motivate, and engage students, characteristics that are considered essential for learning to take place. Furthermore, the presenters of the dramatic and police officer presentation were perceived as experts, more so than were teachers, likely due to the novelty of these presenters and the context in which they are observed. Teachers are familiar to students and are likely to teach classes not related to road safety, and as such are not perceived as experts (Powney et al.,1995).

Extrapolation of the above evidence to programs utilising mock crash scenarios implies that such methodologies, while not necessarily more effective, are certainly no less effective than other approaches and may even have an enhanced quality due to their ability to stimulate and engage students, and strengthen the credibility of messages through expert (or perceived expert) presenters. The potential of such programs can only be improved through an adequate evaluation process.

8.3 Interactive exhibits

Interactive exhibits have long been viewed as educational devices and have been utilised in environments such as zoos and museums. The effectiveness of interactive exhibits is generally assessed according to their ability to attract and hold an individuals attention, the inference being that attending and interacting with a display involves some cognitive investment and therefore must promote some learning (Sandifer, 2003).

In an assessment of RoadZone, an interactive road safety exhibition for 9-14 year olds in New South Wales and the ACT (which is no longer running), Gray (2003) observed the learning behaviours of students as they interacted with displays. He determined that the interactive nature of the exhibit facilitated learning through the creation a stimulating, supporting, and rewarding environment in which to explore road safety. Further assessment of RoadZone users' road safety knowledge pre- and post-visit revealed that 80% of students had added awareness of at least one new road safety issue, and that gains in knowledge were more likely to contain understanding of various issues, for example the need to be aware of other road users, than the dogmatic beliefs, such as "don't drink drive", characteristics of pre-visit beliefs (Gray, 2003). Assessments of interactive exhibits in other fields have also demonstrated their effectiveness as an educational tool for both children and adults (Birney, 1988).

8.4 An evaluation of three educational tools for 4-5 year olds and their influence on behaviour

In an effort to determine the relationship between road safety knowledge and subsequent behaviour Zeedyk, Wallace, Carcary, Jones, and Larter (2001) assessed the impact of three different commercially available educational materials on the road crossing knowledge and behaviour of Scottish school students aged 4-5 years. A total of 120 students from three primary schools in Scotland, each with a different traffic environment (i.e., urban, residential, and rural), were randomly allocated to one of three intervention groups. One group were taught road crossing safety one-on-one using a playmat model, which used toy models of pedestrians, vehicles, trees, and buildings. The second group involved small groups playing a board game, the rules of which were based on safe road crossing techniques (see Zeedyk et al., 2001 for a more complete description), and the third group attended an interactive talk that utilised posters and flip-chart materials.

Road safety knowledge was assessed pre- and post-intervention, and again at a six month follow-up using 11 photographic cards depicting either safe or unsafe road crossing behaviour. Students were also asked to provide a justification for their answer as a means of determining their level of understanding. Note that levels of pre-intervention knowledge did not differ across the three schools, indicating that the traffic environment with which the students were familiar did not influence road-crossing knowledge. Due to difficulties arising with data collection, data from a control sample was only able to be collected at the six-month follow-up stage.

Comparison of pre-intervention scores to post-intervention scores revealed that knowledge had significantly improved in the short-term and was further maintained at least until the six month follow-up. Analysis failed to reveal a significant effect of intervention type suggesting that each of the

interventions used in the study were equally effective in increasing knowledge. It is important to note that while knowledge was significantly improved the actual increase in knowledge itself was not great; on average participants increased knowledge scores by one point. Areas where an increase in knowledge were not observed were largely an effect of scores for those items being close to the maximum at the pre-intervention assessment; there was little to no room for improvement on these. Comparison of the intervention group to the control group further indicated that students in the intervention group performed significantly better than the control group at the six-month follow-up stage.

While the above findings quite clearly demonstrate that the teaching methods employed successfully improved road safety knowledge in students aged 4-5 years these gains were not observed in participants' road crossing behaviour. Following the intervention Zeedyk and colleagues (2001) devised a method that would enable them to observe participants' road crossing behaviour in a natural yet safe environment. Participants for the present study were 47 students who had previously participated in one of the interventions, or as the control group. Under the guise of a treasure hunt participants followed clues that required them to cross the road under a number of situations specially contrived to mirror those used in the knowledge test. Teachers were interspersed throughout the route as an added precaution and local police carefully controlled the traffic environment.

Analysis of video footage revealed that a significant majority of students failed to choose a safe option for crossing the road and the majority crossed the road alone despite the option to ask for assistance (Zeedyk et al., 2001). Comparison of control group participants to those who had participated in one of the interventions revealed no significant difference in safe crossing behaviour. Thus, the significantly greater knowledge of the intervention group failed to influence their behaviour (Zeedyk et al., 2001). However, it should be noted that the nature of the task involved – a school exercise with teachers interspersed at key crossing locations – is likely to have influenced the participants' behaviour. For example, while many of them crossed alone, it is possible that the presence of a teacher on either side of the road led to assumptions of safety (Zeedyk et al., 2001).

While the authors claim that there was a failure of participants to translate knowledge into behaviour, the design and implementation of the observational stage of the study may have influenced behaviour here. These results do, however, suggest that children may only employ road safety behaviour when someone tells them they must.

8.5 Using computer software to teach road crossing skills

Dragutinovic and Twisk (2006) report on the development of training program teaching Scottish children to cross the road using computer software that was developed by Tolmie and colleagues (as cited in Dragutinovic & Twisk, 2006). Tolmie and colleagues developed crossing strategies for different classes of street crossings that were based on the logical sequence of tasks necessary to cross in an ideally safe manner. After identifying these strategies Tolmie et al. developed a computer-based training program that can be used by small groups of children who are guided by an adult trainer. The program requires the children to make decisions about the most appropriate route to help an on-screen character cross the road safely. Where the route involves the use of a crossing the children are required to make decisions about what the character needs to do and in what order to cross the road. Each training session consists of four such traffic problems. Feedback on these decisions through the program such that on-screen progress is stopped until crucial actions are performed.

The training program was evaluated using a pre- and post-intervention design with participants (279 children aged 5-8 years old) randomly allocated to intervention and control groups. Pre- and post-intervention testing were conducted roadside and involved groups of children using the crossings

included in the training program. Observations were made regarding childrens' demonstrated behavioural and conceptual understanding of the road crossing task. Children randomly assigned to the intervention condition then received training with the computer program with all children tested again 10 weeks following the training. Post-intervention tests utilised the same procedures employed in pre-testing.

The results of this evaluation revealed that there were no significant differences between children at the pre-testing stage. However, following the training session children in the intervention group (i.e., those who received training) demonstrated significantly better behavioural and conceptual performance than the control group. Further statistical analysis revealed that correlations between conceptual understanding and behaviour were much higher than pre-test levels at post-testing for children who had undergone training. Together these findings suggest that the computer-based training program was successful at improving knowledge, and that this improvement further influenced behaviour.

8.6 Summary

Various methods of delivery have demonstrated an ability to stimulate, motivate, and engage students, which increases the likelihood that they will remain interested and attentive throughout the presentation, characteristics which are viewed as essential components of learning. The use of experts should increase the credibility of the information, however this is dependent on the individual's perceptions of, and attitudes towards, the expert in question. Despite evidence suggesting that the above approaches should enhance the learning experience there is little evidence demonstrating that such approaches facilitate the transfer of knowledge into behaviour.

9 Discussion

This report has provided an overview of the five strategies employed in road safety education (RSE) drawing on a number of examples of each from both Australia and abroad. A key component of this review has been to provide comment on the effectiveness of RSE programs. Programs currently in use in South Australian schools have been included, even where no evaluation was available, and any other program that either adopts a novel approach to road safety education, or shows some promise (based on best practice principles, etc.). Based on this information a number of observations can be made.

First, given the difficulties inherent in undertaking program evaluations it is hardly surprising that adequate evaluations of existing RSE programs are somewhat lacking. In the past there has been a tendency for evaluation processes to be either overlooked entirely, because they require fore-planning, resourcing (including funding, materials, and access to control and intervention samples), and time, included as an afterthought, or are concerned primarily with the implementation of the program (e.g., process evaluations). Given these limitations there is some scope for improving program evaluations in the future, especially given that the overarching principle of the school based road safety education principles demand that RSE programs be evidence-based (SDERA, 2009). Furthermore, the development and implementation of new road safety programs should also include an evaluation process using appropriate methodology including, where possible, randomised design and valid assessment instruments, either existing or specially developed, to measure effectiveness against established outcomes. It would also be beneficial for such evaluations to employ longitudinal design; following participants through early adulthood could provide a level of insight into RSE not currently available.

It is also apparent that the predominant focus of most road safety education approaches has been either the very young or adolescents of driving age. While the rationale for targeting these particular groups is sound it does mean that school students in the early high school years (years 8 and 9) are largely overlooked. While the majority of programs for this age group are largely curriculum based, there is the potential for programs focussing on risk-taking and passenger issues (e.g., LifeSkills Training, or SPIY) to serve as a useful precursor to more driver focussed RSE. Another identifiable gap arises from the fact that the majority of road safety education programs are provided in-school to school students, such an approach may fail to reach a number of key groups. First, students who are truant will likely not receive RSE thus missing out on any potential benefits. This group is further recognised as being at high risk in a number of other areas including substance use and delinquent behaviour, and as such could be those with the most to gain from such education (Somers & Gizzi, 2001; Weden, & Zabin, 2005). The second group may be those who leave school early to start work or an apprenticeship. These individuals are also young drivers who may benefit from road safety education, however, with the exception of driving instruction or self-enrolment in driver training courses, there is little in the way of programs available to these. The Road Ready program in ACT requires the provision of this program to such individuals by non-school providers – assessment of such programs are beyond the scope of the present review.

Many popular programs are of limited duration, typically involving one-off presentations. It is unclear whether schools endeavour to place these programs within their own road safety context (i.e., link with the school's road safety curriculum, if they have one) or provide supplementary sessions (e.g., group discussions, reflecting tasks, etc.) to reinforce the knowledge and information presented. Curriculum-based programs on the other hand tend to have longer duration utilising multiple sessions of delivery, which may enhance their efficiency.

Previous evaluation of an earlier version of the YDEP, a one-off presentation, pointed to the limited effectiveness of the program. However, this review also resulted in the significant revision of the program's content and delivery. The program now involves an interactive presentation including a modern multi-media presentation, which, when considered alongside the credibility of the presenter, may be more effective than its predecessor. One concern about YDEP in its present form is its limitation to a single session; the program may benefit from increased delivery, or, at the very least, supplementary tasks or follow-ups. Since these changes have been made no evaluation has been conducted, in light of the information presented it is a recommendation of this report that a complete evaluation be conducted before any decision regarding this program be made. A possible role for one-time programs such as SAPOL's YDEP or the Street Smart program provided by the RAA may be to supplement existing RSE by linking them with road safety curriculum activities.

Curriculum-based approaches currently have no fixed place in the curriculum and are largely implemented independently by schools however and wherever they see fit. It has also been observed that finding time to include RSE in already full teaching schedules can be difficult. The two responses to this may be to create space by making road safety a compulsory subject, or incorporating RSE into existing subjects, the latter being the current approach adopted within South Australia and a number of other jurisdictions. Both approaches have not been demonstrated to be particularly efficacious, however there is room for improvement as current curriculum-based approaches are lacking evaluation.

RSE in schools tends to adopt a fairly simplified approach, seeking to target as many as possible as generally as possible. As such there are a number of consequences regarding effectiveness. For example, standard approaches are likely to be effective amongst individuals who are already likely to be relatively low-risk drivers. Concomitant with this are another group for whom standard approaches to RSE will have no effect, or have a reverse effect (as that observed for driver training programs) such that they increase risk. Drawing on principles of offender rehabilitation, the Risk-Needs approach (Andrews & Bonta, 2002) programs that seek to change the behaviour of individuals need to a) target the risk factors for that behaviour, b) programs also need to be responsive towards the needs of the individual (e.g., consider cognitive ability, reading skills, etc). Another aspect of intervention effectiveness is that the level of intervention needs to be responsive to the individual's level of risk. It has been shown that low intensity interventions for high-risk individuals have little to no effect, while high intensity interventions for low-risk individuals can actually have a negative affect, effectively increasing their level of risk (Andrews & Dowden, 2005). While such principles are used to guide offender rehabilitation programs around the world, for both juvenile and adult offenders it would be remiss to overlook their application to the field of RSE. The basic goals of both RSE and rehabilitation programs are to reduce the likelihood that the individual will engage in a specific set of risk taking behaviours. As such the field of RSE may benefit much from drawing on other fields where behaviour change is a recognised priority.

If there is one issue that ignites community passions regarding the need for road safety education it is the involvement of young drivers in crashes, for many the obvious solution to this problem is to provide education that creates safer drivers. Adolescence is a period characterised by risk taking behaviour. It is also the point at which many individuals obtain their licence, effectively providing them with another legitimate avenue to engage in such behaviour. The nature of adolescent risk taking is such that long-term consequences do not feature in the decision making process. As such one of the major hurdles faced by RSE is not so much the imparting of knowledge, but rather preventing this from being over-ridden by peer influence and the heat of the moment. A promising shift in RSE has been recognition of the importance of developing and fostering attitudes amenable to safe and responsible road usage. The use of programs that target underlying causes of risk taking behaviour is also showing great promise.

A number of programs are showing some promise, particularly those that indirectly target road safety by addressing the underlying causes of risk taking behaviour, or by increasing resilience. These programs, RRISK for example, have been demonstrated to be more effective than traditional driver education programs (at least for young drivers) and have a positive effect on crash involvement. Such programs are also attractive because of their potential to achieve positive gains in a number of areas (e.g., delinquency, substance use, mental health, etc.). While the programs mentioned within this report have some demonstrable success there remains room for improvement in that young road users would be well served by programs that address factors that underpin adolescent risk taking behaviour. As such improvements can be made in the following areas:

- Some effort should be made to determine the risk factors associated with road safety.
- Future approaches should seek to address the most common issues of adolescent risk taking in conjunction with RSE.

Research into driver training programs suggests that training that improves risk and hazard perception, and highlights individual limitations rather than producing overconfidence may also have some positive effect, there is, however, a fine line between the two outcomes. Further evaluation of the efficacy of such programs is also required to determine both their effectiveness and how they might be improved. Current thought, which is reflected in GDL systems, suggests that increasing experience under supervised conditions will also have a protective effect.

10 Conclusion

The effectiveness of current road safety educational programs remains largely undetermined as the available evidence is somewhat equivocal regarding the influence of RSE on road safety behaviour. While there is little evidence showing that it works, there is a similar lack of evidence showing that it does not. To summarise:

- For the most part current approaches to RSE do not cause harm and the value in passing on road safety knowledge should not be overlooked.
- RSE should be used in conjunction with other strategies such as graduated licensing schemes, media campaigns, and improvements in infrastructure for pedestrians and vulnerable road users.
- Programs that result in early licensure may negate gains in knowledge by increasing an individual's driving exposure, thus increasing their exposure or likelihood of encountering crash situations. Similarly, driver training programs also raise concerns that it will instil a level of confidence in young drivers that is not commensurate with their level of skill.
- Indirect programs addressing resilience and risk taking issues hold some promise.

The future development of RSE programs should be evidence-based and founded on established principles of best practice both for education and behaviour change. Finally, the importance of well-designed and implemented evaluations cannot be stressed enough.

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Appendix A – Summary of selected RSE programs

Table A1 provides an overview of selected programs that were discussed in this report. The table includes the focus of the program, the intended audience, and a brief summary of any available evaluation.

Table A1
Summary of selected RSE programs available to school students

Program	Provider	Strategy	Focus	Target audience	Duration	Evaluation summary
Road Awareness and Accident Prevention (RAAP)	South Australia Metropolitan Fire Service	One-time intervention	Consequences of speeding and DUI, crash trauma, and attitude change.	Years 11 & 12	90 mins	NA
Youth Driver Education Program	South Australia Police	One-time intervention	Choices/risks/ consequences; Causes of crashes: speed, DUI, driver distraction, attitudes, peer pressure.	Years 11 & 12	90 mins	Woolley & Taylor (1998): No significant change in self-perceptions of driver skills or behaviour. However, findings suggest anxiety regarding driving was significantly lower after attending YDEP.
Youth and Road Trauma Forum	Westmead Hospital Trauma Service & the NRMA (NSW)	One-time intervention	The Forum seeks to provide young people with the information to enable and encourage them to become safer road users: 1 Encouraging young people to take responsibility for themselves, their passengers, and other road users; 2. Promoting understanding of the consequences of risky driving; 3. Providing tips on how to be safe on the road.	Years 11 & 12	4 hours	MAA and the Injury Risk Management Research Centre have conducted a preliminary evaluation. Based on limited data from discussion groups Hatfield et al. (2009) report that students retained key messages regarding the consequences of crashes and about their responsibility to ensure their own and others' safety on the road. However, some ambiguity was found with regard to messages relating to other issues of risk taking behaviour (e.g., drink/drug driving, driver distraction) and tips for safer driving.
Street Smart	Royal Automobile Association of South Australia (RAA)	One-time intervention	The seriousness and consequences of road crashes. Promote skills and knowledge for safe driving.	Years 10-12	4 hours	A brief evaluation provided by the RAA (2009) indicated that more than 90% of students said that Street Smart had an impact on their attitude to drink driving and to speeding. Furthermore, 83% agreed that Street Smart would have an impact on their attitude to texting while driving. However, these findings do not adequately show either attitude nor behavioural change.
Rotary Youth Driver Awareness (RYDA)	Rotary International	One-time intervention	RYDA focuses on attitude and awareness to help young adults become better road users. The program also highlights the privilege and responsibilities of owning and driving a motor	16-17 Year olds	1 day event	Evaluation by Elkington (2005) suggests RYDA is effective at producing short-term gains in knowledge, however these gains become negligible over longer periods (i.e., 3 months) if they were not reinforced. No long-term changes were

			vehicle. RYDA also seeks to illustrate the rights and responsibilities of passengers and pedestrians.			observed in self-reported behaviours. RYDA content and delivery has since been reviewed and is expected to be implemented in 2010. This new version is yet to be evaluated.
Safety City	Red Cross, Greater Columbus, Ohio.	One-time intervention	Safe road crossing, stranger awareness, and dialling 911 in an emergency.	Kindergarten children.	20 minutes	Evaluation by Luria, et al. (2000) found no differences between treatment or control group participants in their knowledge of safe road crossing at pre- or post-test occasions. No significant improvements in knowledge were observed for ether group.
RRISK (Reduce Risk Increase Student Knowledge)	An intersectoral partnership made up of health professionals, local governments, and education providers from NSW. See www.rrisk.com.au	Indirect or Holistic	Reducing youth risk-taking and building resilience by empowering young people with the knowledge, attitudes, and skills to make informed decisions about driving and other risk taking behaviours.	Years 10-12	1 day seminar & additional complementary in-school activities	Zask, van Beurden, Brooks, and Dight (2006) compared RRISK participants to controls and found that participants demonstrated increased knowledge with regard to used car safety and determining if someone is too drunk to drive. There was also some evidence of attitudinal change. Senserrick et al. (2009) found that participants who attended the RRISK seminar were 44% less likely to become involved in a crash, while participants of a driver focused program, which had no impact on risk of crashing.
LifeSkills Training	Training and resources are provided by National Health Promotion Associates (USA)	Indirect	Resilience based program that addresses risk factors associated with substance use	The program targets 2 age groups: Primary aged: years 3- 5 OR 4-6 And upper-primary, lower secondary: Years 6- 8 OR 7- 9.	Primary-age program consists of 24 sessions designed to be conducted sequentially over 2-3 years. Upper-primary, lower-secondary program consists of 30 sessions offered sequentially over 3 years.	Evaluation of the program's influence on driving outcomes found that, after controlling for effects of gender and alcohol consumption, students who received the Life Skills 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 Life Skills Training program on risky driving were mediated by the programs positive influence (i.e., it improved) on anti-drinking attitudes (Griffin, et al., 2003).

Safe Drive Test Drive	Safe Drive Training (www.sdt.com.au)	Driver training	Risk factors, attitudes, driver behaviours, and defensive driving skills.	High school students with a learner's or provisional driver's licence	1 day course	NA
Beginner Driver Education (BDE) curriculum	Canadian Standards Association, Ontario, Canada	Driver training	• Improve road safety for all road users. • Improve the driving competency of beginner drivers. • Develop respectful and responsible attitudes amongst beginner drivers. • Enable beginner drivers to drive in a confident and safe manner.		Minimum 20 hours in-class, 10 hours in-car, with a further 10 hours spent on other activities.	NA
School Drug Education and Road Aware (SDERA): Choices and challenges.	West Australia Department of Education	Curriculum based	A set of three resources which focus on building resilience and providing educational material that is relevant to the developmental stage of each group (K-year 10)	Numerous resources are available from Kindergarten to Year 10.	varies	Planned evaluation currently underway with final stage of data collection planned for Term 4 2010.
Skills for Preventing Injury in Youth (SPIY)	Queensland Department of Education and Training (DET)	Curriculum based	To reduce the prevalence of risk taking and associated injury amongst adolescents by increasing first aid skills and protective behaviours towards risk-taking peers, and decreasing adolescent risk taking behaviours. Includes a number of road safety scenarios.	Year 9	8 x 50 minute sessions delivered weekly.	A short-term evaluation SPIY (Buckley, Sheehan, & Shochet, 2010) suggested that the program had a positive influence on the risk taking behaviours of students who participated
SDERA: Keys for Life	SDERA	Curriculum based	Development of knowledge, skills, and attitudes towards becoming a safer driver. Students who undertake Keys for Life can also sit the learner's permit theory test at school. Passing the theory test also gains a discount in the cost of the learner's permit fee.	15-16 year olds	10 – 18+ hours	No currently evaluation available, however an evaluation is planned.
SDERA: Licensed to Drive	SDERA	Curriculum based	Embeds road safety education within the Health Studies curriculum.	High school students.		NA

Road Ready (ACT)	ACT Government	Curriculum based	Seeks to reduce the risk of young novice drivers becoming involved in crashes through learning about risks, hazards, and the complexities of driving, and also to encourage gaining as much driving experience as possible.	Year 10	13 modules delivered over 13-17 hours.	Evaluation proves somewhat equivocal, however there is some indication of improvements in increased driving practice and lower rates of infringement and crash amongst Road Ready graduates (Wundke et al., 2004). This is likely counteracted by higher licensure rates observed since the programs implementation.
Your Turn: Road safety choices for middle years	Department for Transport, Energy and Infrastructure (DTEI) South Australia & DECS	Curriculum based	Content focuses on the importance of personal responsibility and employs a number of strategies to encourage young people to think critically and develop their own understanding of road safety issues.	Years 6-9	15 topics spread over 5 units	NA
Way2Go	DTEI (South Australia)	Multi-modal	The focus of Way2Go is to develop safer, greener, and more active travel amongst South Australian primary school students. Bike Ed is also available under this scheme.	Reception to Year 7	3 age-appropriate resource kits covering 5 units that cover road safety, and social and environmental impact of motorized transport	No evaluation of the present incarnation, however evaluations of the Safe Routes To School program (its Victorian predecessor) suggest that improvements to pedestrian and cyclist infrastructures in conjunction with appropriate training (Delaney et al., 2004). Reports on the effectiveness of bicycle education programs are somewhat more equivocal, however the preponderance of evidence tends to suggest that such training is harmful rather than protective (Colwell & Culverwell, 2002; DTEI, 2010).
Speak Out!	Norwegian Public Roads Authority (NPRA).	Multi-modal	To reduce injury amongst teenage passengers by encourage them to speak out against risky driving.	Adolescents aged 16-19 years.	Involves a video, oral presentation, and promotional materials.	Limited evaluation determining the effectiveness of *Speak Out!* suggests that the program has produced a significant reduction in crash related injuries for the teenaged passengers of teenaged drivers (Elvik, 2000).