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Climate Schools: Universal computer-based programs to prevent alcohol and other drug use in adolescence

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CLIMATE SCHOOLS: UNIVERSAL COMPUTER-BASED PROGRAMS TO PREVENT ALCOHOL AND OTHER DRUG USE IN ADOLESCENCE

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BACKGROUND

Early initiation to drug use is associated with a range of negative consequences including substance use disorders, co-morbid mental health problems, juvenile offending, impaired educational performance and early school drop-out, resulting in negative impacts on both current functioning and future life options [1-3]. Preventing drug use and misuse in young Australians is essential and the school setting is the ideal location for delivering such prevention programs [4]. Although school-based prevention programs do exist, the efficacy of such programs is contentious [5-8]. Given that school-based drug prevention is the primary means by which drug prevention education is delivered to adolescents, it is essential to focus on increasing program efficacy. Previous research has shown that two factors compromise the efficacy of the school-based prevention programs: (1) the focus on abstinence-based outcomes [5] and (2) implementation failure [9]. Hence, the aim of the current research was to develop an innovative new platform for the delivery of drug prevention education which would potentially overcome such concerns. This new platform of delivery is known as CLIMATE Schools.

CLIMATE SCHOOLS

The CLIMATE Schools drug prevention programs are designed to overcome the factors which have been identified as compromising program efficacy by being based on a harm-minimisation approach and being developed in such a way as to enhance high fidelity program implementation. Specifically, there is a growing body of evidence suggesting that harm-minimisation programs for drug use could potentially be more effective than abstinence-based programs as they provide greater scope for preventive information and skills, whilst catering for all young people irrespective of levels of use [10-12]. In terms of improving implementation, the CLIMATE Schools programs have also been developed in collaboration with teachers, students and relevant health and legal professionals to ensure they address different issues which have been identified to compromise implementation (e.g., program complexity, teacher workload, teacher training and program adaptation). Specifically, each of the CLIMATE schools drug prevention programs is a curriculum-based program consisting of six lessons, each with two components; a 15-20 minute computer-based component and an array of prepared classroom activities for teachers and pupils. The computer component involves students navigating their way through a cartoon-based teenage drama. Each lesson deliberately forms part of an ongoing teenage drama to encourage teachers to present all lessons and avoid the temptation to omit any one of them. The computer delivery guarantees that the complete content is consistently delivered to each student overcoming the majority of the obstacles to effective program implementation. The classroom activities are included to allow students to interact with the content in relation to their own lives. These activities include role plays, small group discussions, decision making and problem solving activities and skill rehearsal, all of which have been identified as being central to program efficacy [13-19].

CLIMATE SCHOOLS: ALCOHOL MODULE

The first program developed to test this innovative new model for prevention addressed alcohol misuse and related harms in adolescents. This program, titled CLIMATE Schools: Alcohol Module, was evaluated [11] utilising a randomised controlled trial (RCT) in 16 New South Wales (NSW) and Australian Capital Territory (ACT) schools. This evaluation revealed that the CLIMATE Schools: Alcohol Module was effective in increasing alcohol-related knowledge of facts that would inform safer drinking choices, and in decreasing the positive social expectations which students believed alcohol may afford. For females, the program was effective in decreasing average alcohol consumption, alcohol-related harms and the frequency of drinking to excess (> 4 standard drinks; 10g ethanol). For males, the behavioural effects were not significant. The CLIMATE Schools: Alcohol Module has also been evaluated with a different sample of Australian students [20]. The RCT used in the cross-validation trial comprised 10 schools from NSW. The results demonstrated the CLIMATE Schools: Alcohol Module to be effective in increasing alcohol related knowledge up to six month following the intervention, and reducing average consumption of alcohol immediately after the intervention. The results of this module were promising and provided the impetus to assess if this innovative new platform of delivery for school-based drug prevention could be extended to other drugs of concern in adolescence.

Cannabis and psychostimulants became the next area of focus since these are two of the three most commonly used illicit drugs among Australian youth [21]. To address both drug/drug classes, two separate modules needed to be developed, as for prevention to be effective it must be relevant and developmentally appropriate. Cannabis and psychostimulants have very different median ages of initiation and hence for these programs to be relevant and developmentally appropriate they need to be delivered at different ages. To prevent uptake and minimise drug-related harm, the cannabis intervention was developed to be implemented in Year 8 of high school (ages 12-14), as by 13 years of age, 10% of the population have tried cannabis. The psychostimulant program was developed for Year 10 of high school (14-16 years of age), when the prevalence of methamphetamine/amphetamine (meth/amphetamine) and ecstasy use just starts to increase. The programs, however, were also developed to provide a booster session for previously addressed drugs since the research evidence suggests that including booster sessions can enhance program efficacy. Hence, two new modules were developed and evaluated: the CLIMATE Schools: Alcohol and Cannabis Module and, the CLIMATE Schools: Psychostimulant and Cannabis Module.

CLIMATE SCHOOLS: ALCOHOL AND CANNABIS MODULE

The CLIMATE Schools: Alcohol and Cannabis Module was evaluated using a cluster RCT in 10 NSW schools. The evaluation revealed that in comparison with usual drug education programs, students in the intervention group showed significantly greater improvements in alcohol and cannabis knowledge at the end of the course and the six month follow-up. In addition, the intervention group showed a reduction in average weekly alcohol consumption and frequency of cannabis use at the six month follow-up. No differences between groups were found on alcohol expectancies, cannabis attitudes, or alcohol and cannabis harms.

CLIMATE SCHOOLS: PSYCHOSTIMULANT AND CANNABIS MODULE

The CLIMATE Schools: Psychostimulant and Cannabis Module was also evaluated using an RCT in 21 NSW and ACT schools. This evaluation revealed that the CLIMATE Schools: Psychostimulant and Cannabis Module was effective in increasing knowledge of cannabis and psychostimulants and decreasing pro-drug attitudes. In the short-term the module was effective in subduing the uptake of ecstasy and decreasing the frequency of use. Females who received the CLIMATE Schools: Psychostimulant and Cannabis Module also used cannabis significantly less frequently than students who received drug education as usual. There were no changes in meth/amphetamine use or harms resulting from cannabis or psychostimulant use in general. The low prevalence of use is the most likely reason for why the CLIMATE intervention did not impact on drug-related harms. Finally, the CLIMATE intervention was effective in decreasing students' intention to use meth/amphetamine and ecstasy in the future.

CONCLUSIONS

The findings from the evaluation of all three CLIMATE Schools drug prevention programs provides evidence that school-based drug prevention programs based on a harm-minimisation approach and delivered by computer can offer an innovative new platform for the delivery of prevention education for both licit and illicit drugs in schools. The mode of delivery was certainly welcomed by both students and teachers, with the latter rating these programs to be superior to other drug prevention approaches and reporting that they would be likely to continue using these programs in the future. The CLIMATE drug prevention programs now offer a suite of sequential and developmentally appropriate interventions catering for both licit and illicit drug use. What remains to be done is to trial the complete suite and assess if this enhances programmatic effects.

CHAPTER 1: INTRODUCTION

Adolescence is characterised by a phase of increased willingness to engage in risky and sometimes antisocial behaviour [22]. For the majority of people, the likelihood of engaging in risky behaviour typically reaches its peak during the adolescent years. One such behaviour of concern is alcohol and other drug use which accounts for a significant percentage of the burden of disease in Australia [23] and forms a major component of preventable health and social costs experienced by young people [24]. Given this burden, prevention is essential. In order for prevention to be successful it needs to be implemented before drug use begins or harmful patterns are established [25]. The school setting is an ideal location for prevention [4, 26-29], but the efficacy of school-based drug prevention is contentious [5, 6]. This is of significant concern, given that school-based prevention programs are the primary means by which drug prevention is delivered to adolescents [30, 31]. Improving the outcomes of such interventions is essential.

Two factors have been identified which may account for the apparent lack of efficacy of school-based drug prevention curricula: implementation failure [9, 32] and the focus on abstinence-based outcomes [5, 33, 34]. The aim of the current research program was to determine if school-based drug prevention programs based on a harm-minimisation approach[1], delivered utilising computer technology would have the potential to address such concerns. Given that alcohol is the drug of greatest concern during adolescence [21], the first program developed to test this innovative new model for prevention, addressed alcohol misuse and related harms in adolescents. This program, titled CLIMATE Schools: Alcohol Module, was developed in collaboration with teachers, students, parents and specialists in the area of education and alcohol and other drug use [35].The final curriculum-based program consists of six lessons, each with two components. The first component involves the students completing an interactive computer-based program, with the second consisting of a variety of individual, small group and class-based activities. The evaluation of this program [11], utilising a randomised controlled trial (RCT) in 16 New South Wales (NSW) and Australian Capital Territory (ACT) schools, demonstrated that CLIMATE Schools: Alcohol Module was effective in increasing alcohol-related knowledge of facts that would inform safer drinking choices, and in decreasing the positive social expectations which students believed alcohol may afford. For females, the program was effective in decreasing average alcohol consumption, alcohol-related harms and the frequency of drinking to excess (> 4

[1] It is important to be clear that, consistent with a harm-minimisation framework, the harm-minimisation message adopted in the current programs was to strongly encourage abstinence as a desirable outcome, while accepting that some young people will use drugs and hence provide information and skills to attempt to minimise or prevent the consequences or effects of alcohol and other drug use on both the individual and society.

standard drinks; 10g ethanol). For males the behavioural effects were not significant. The results of this module were promising and provided the impetus to assess if this innovative new platform of delivery for school-based drug prevention could be extended to other drugs of concern in adolescence.

Given that cannabis and psychostimulants are two of the three most commonly used illicit drugs among Australian youth [21], these were importantly the next drugs on which to focus.

The initial aim of the current research was to develop a single new module titled CLIMATE Schools: Cannabis and Psychostimulant Module for which funding was sought and obtained from the Australian Government Department of Health and Ageing (AGDHA). Reviews of epidemiological data and research on evidence-based prevention, however, suggested that this program would best be divided into two new modules (CLIMATE Schools: Alcohol and Cannabis Module; and CLIMATE Schools: Cannabis and Psychostimulant Module) delivered at different stages of adolescent development, rather than as one combined program. Specifically, the decision to create two modules was based on the following two considerations.

Differing ages of initiation to cannabis and psychostimulant use: For prevention to be effective it must be both relevant and developmentally appropriate [14, 33, 36-38]. It is argued that there are three periods during adolescence when the effects of school-based drug prevention interventions can be optimised: the inoculation phase, early relevance phase and the late relevance phase [33, 39]. The inoculation phase is the phase prior to initial drug experimentation. The early relevance phase occurs when most students are experiencing initial exposure to drugs. Finally, the late relevance phase is a phase when the prevalence of drug use increases and the context of use changes. The goal of the CLIMATE Schools programs is to decrease the uptake of drugs and prevent the establishment of harmful patterns of use; that is, the goal is to inoculate students who may be at risk of the uptake of drugs prior to the initiation of drug use. With this intention in mind, however, epidemiological data suggests two different ages at which a program aimed at preventing cannabis and psychostimulant use should be implemented [40]. Specifically, by 13 years of age, nearly one in 10 young Australians have tried cannabis. At this same age, however, less than 3% percent have tried amphetamines and even fewer have tried ecstasy [41]. Hence, to deliver a prevention program for cannabis in the 'inoculation phase', this would need to occur prior to the age of 13 years. At this age, however, information on amphetamines and ecstasy would not be relevant or developmentally appropriate. The prevalence of amphetamine and ecstasy use only starts to increases at approximately 15-16 years of age, indicating that the preferred time for the implementation of a prevention program for psychostimulant use would be just prior to this age. By this time, however, the prevalence of those having used cannabis is in excess of 20%, making it too late for the introduction of cannabis prevention material.

Sequential and developmentally appropriate programs which include the use of booster sessions help to reinforce and sustain prevention efforts: The majority of the research evidence, with a few exceptions [15, 42], also suggests that use of booster sessions is an effective means of enhancing both immediate and long-term prevention outcomes [43, 44]. Given the changing phases of adolescent development, it has been suggested that it is unrealistic to expect drug prevention programs to have long-term effects [45]. The influence of peers, family, school and society vary with time; likewise, the context of drinking and other drug use [45]. Research suggests that to maintain positive program effects and cater for changing student needs it is essential to provide booster sessions over the subsequent years [7, 13, 45]. These booster sessions provide sequentially delivered messages which can be tailored to different developmental levels.

Given these two considerations, it was determined that the most effective schools-based drug prevention program would consist of a sequential and developmentally appropriate suite of drug prevention programs with appropriately built-in booster sessions. Hence, the following course was considered to most appropriately address evidence based principles for prevention:

1. CLIMATE Schools: Alcohol Module (delivered Year 7/8) (11-13 years of age)
2. CLIMATE Schools: Alcohol and Cannabis Module (delivered Year 8) (12-13 years of age)
3. CLIMATE Schools: Cannabis and Psychostimulant Module (delivered Year 9/10) (14-15 years of age)

From the outset of this project, the research evidence had pointed to the need for two separate modules to address Cannabis and Psychostimulant use, rather than one combined module. Hence, the decision was made to seek additional funding to allow us to develop this extra module which would ensure that the CLIMATE Schools drug prevention programs adhered closely to best practice drug prevention research. We are thankful to the following funding bodies, whose funding combined with that provided by the AGDHA, have made this possible:

- Alcohol Education and Rehabilitation Foundation
- Australian Research Council
- National Health and Medical Research Council, and
- National Drug and Alcohol Research Centre.

It is clear that a sequence of developmentally appropriate programs, delivered over the course of the teenage years, would be ideal for reinforcing prevention messages and catering for changing developmental needs over time. Given, however, the competition for time within the school environment, to allow for optimal program effectiveness, it was also considered pragmatic to design each program to be a stand-alone module, should some schools prefer not to implement the entire suite. Hence, the aim of the current research was to develop and evaluate the latter two CLIMATE Schools modules and determine whether:

- it is both feasible and acceptable in the school-setting to extend a harm-minimisation approach to the prevention of cannabis and psychostimulants (illicit drugs);
- the CLIMATE Schools: Alcohol and Cannabis Module is effective in decreasing alcohol and cannabis use, misuse and related harms; and
- the CLIMATE Schools: Cannabis and Psychostimulant Module is effective in decreasing cannabis and psychostimulant use, misuse and related harms.

To set this research in context, Chapter 2 of this report provides a brief review of alcohol, cannabis and psychostimulant use in Australia, with a particular focus on the use by young Australians. Chapter 3 provides a brief review of the obstacles to the delivery of school-based prevention and the rationale for why this innovative new platform of delivery utilised in the CLIMATE Schools Modules is proposed to overcome such concerns. Chapter 4 will briefly review the development, evaluation and cross validation of CLIMATE Schools: Alcohol Module. Chapter 5 will outline the RCT used to evaluate the CLIMATE Schools: Alcohol and Cannabis Module and Chapter 6 will outline the RCT used to evaluate the CLIMATE Schools: Psychostimulant and Cannabis Module.

CHAPTER 2: DRUG USE IN AUSTRALIAN YOUTH[2]

Alcohol use in Australia

The need for prevention in the area of alcohol-related harm is clear. Alcohol harm was responsible for 3.2% of the total burden of disease and injury in Australia in 2003 [23]; it is second only to tobacco in the cause of drug-related morbidity, mortality and economic cost [46, 47]. In 1998, an estimated 3,271 Australians died as a result of hazardous and harmful levels of alcohol consumption [47]. The potential years of life lost due to alcohol was estimated at 21,147 years [47]. Of the total $55.2 billion spent on drug-related costs in Australia in 2004-2005, tobacco accounted for 56.2%, alcohol accounted for 27.3%, with all illicit drugs combined accounting for 14.6% of the total cost [46].

Alcohol use in Australia is widespread [21]. Nine out of every 10 Australians aged over 14 years have consumed a full glass of alcohol in their lifetimes. More than 80% of Australians have consumed alcohol in the previous year and approximately 50% consume alcohol at least weekly with 4.3% suffering from an alcohol use disorder [48].

Alarmingly, a high percentage of Australians put themselves at risk of experiencing acute and chronic harms from alcohol. Specifically, 11.3% of Australians over the age of 14 years drink at risky and high-risk levels for chronic harm, and approximately 35% put themselves at risky and high-risk levels for acute harm at least yearly or more often [21]. Clearly, alcohol use and misuse in Australia is part of the culture; a culture which makes prevention in young people a substantial challenge.

Alcohol use in young Australians

Despite the sale of alcohol being restricted to those over the age of 18 years [49-55], it is clear that by early adolescence the majority of young people have tried alcohol, with exact estimates varying depending on the particular survey and means of sampling [56]. According to the 2005 Australian Secondary Students' Alcohol and Drug Survey (ASSAD) [57], by 14 years of age, 86% of young people have tried alcohol. In the 2004 National Drug Strategy Household Survey (NDSHS), by age 14, 80% of the population had tried alcohol [35]. In both surveys these figures rise consistently each year until, by age 17, at least 90% have tried alcohol.

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[2] Sources for Chapter 2:

Chapter 2 has been drawn from the following document and modified:

> Vogl, L. E. (2007). CLIMATE Schools: Alcohol Module - The feasibility and efficacy of a universal school-based computerised prevention program for alcohol misuse and related harms. Unpublished PhD, University of New South Wales, Sydney.

The median onset for alcohol consumption, as defined by the consumption of a full glass of alcohol, is 16 or 17 years, with significant numbers also reporting initiation at the ages of 14 or 15, but also at 18 or 19 [56]. Patterns of youth alcohol consumption have not changed dramatically in the past 10–15 years, as evidenced by only minor fluctuations in the mean age of onset of alcohol consumption between 1995 and 2007 [58], and minor fluctuations in the median age of onset of alcohol consumption since 1991 [56]. Females are consistently older than males when they initiate alcohol use [56].

Of considerable concern is the significant number of young people who place themselves at risk of both chronic and acute harm from alcohol. Specifically, according to the 2007 NDSHS, 8.8% of 14-19 year olds place themselves at risky and high-risk levels for chronic harms and close to 40% place themselves at risky and high-risk levels for acute harm at least yearly [21].

The potential for harm which can result from such high levels of alcohol consumption is made more tangible when considering data on the morbidity and mortality which results from the consumption of alcohol by young Australians. The high levels of acute intoxication from alcohol are evidenced by data from the National Hospital Morbidity Database, which shows that there were almost 3,000 hospital separations among young people aged 15–24 years in 2005-2006 as a result of acute alcohol intoxication [59]. Comparison with earlier data on hospital separations reveals that hospitalisations as a result of alcohol intoxication have increased substantially since 1998-1999 for both young males and females. For young males, the hospital separation rate for alcohol intoxication increased from 66 to 107 per 100,000 from 1998/1999 to 2005/2006. For young women, the rate doubled over this time from 46 to 99 separations for 100,000. Young Australians are clearly a group of considerable concern, as in 2005-2006, 15-19 year olds had the highest level of hospital separations for acute intoxication from alcohol compared with all other age groups.

In another study which also examined hospitalisation for alcohol attributable injury and disease, it was found that 100,000 15-24 year olds were hospitalised for alcohol attributable injury and disease over a nine year period (1993/1994-2001/2002)[60]. The most common conditions leading to alcohol-attributable hospitalisations included assault, falls, road injury, alcohol abuse and dependence and suicide. A considerable number of deaths in this age group are also caused by alcohol use. Specifically, in Australia between 1993/1994 to 2001/2002, 15% of all deaths in the 15-24 year age range were a result of alcohol-attributable injury and disease due to risky / high risk drinking [60]. The most common causes for alcohol-attributable death for young people were road injury, suicide and violence. Male alcohol-attributable death rates are about four times greater than that for females. Clearly, the number of young people who place themselves at risk of both acute and chronic harm is of concern and warrants intervention.

Cannabis use in Australia

Cannabis is the most commonly used illicit drug in Australia, with 9.1% of Australians over the age of 14 years reporting use in the past 12 months, and 33.5% reporting having used in their lifetime [21]. Globally, cannabis is also the most widely used illicit drug in the world with an estimated 4% of the world's adults using cannabis in 2006 [61].

In Australia, in terms of patterns of use, males (37%) are more likely than females (30%) to have used cannabis in their lifetime [62]. In recent users, the most frequently used form of cannabis used are the flowering heads of the plant ('head') (65.4%) and the least frequent is 'hash oil' (5.6%). Recent users were more likely to smoke the drug as a joint/ reefer/ spliff (84.3%), followed by smoking with a bong or pipe (81.7%), and approximately 65% of recent users combine cannabis with tobacco. Australians most frequently use cannabis within private homes and obtain it from friends or acquaintances. Alcohol is the drug most commonly used with cannabis, or used as a substitute when cannabis is not available. The majority of recent cannabis users (33.5%) report that they use cannabis once or twice a year, but as many as 15% report using cannabis daily. In terms of cannabis use disorders, the 1997 National Survey of Mental Health and Wellbeing (NSMHWB) found approximately 2% of Australian adults were diagnosed with a DSM-IV cannabis use disorder in the previous year, with cannabis dependence (1.5%) being the predominant diagnosis [63]. A heartening trend which has been observed in Australia is the significant decline in the use of cannabis since 1998. According to the NDSHS from 1998 to 2007, the prevalence of past year cannabis use declined from 21.3% to 11.6% for males and 14.7% to 6.6% for females [21]. This trend is also evident in young Australians.

Cannabis use in young Australians

In 2007, 20% of 14-19 year olds reported having used cannabis in their lifetime and approximately 13% reported past year use [21]. This represented a decline in use compared with patterns observed in 1998, where 35% of males reported past year use, compared with 13.1% in 2007. For females, 34.2% reported past year use in 1998, compared with 12.7% in 2007. This is similar to the pattern of results found in the ASSADS conducted in 2005 [41], which showed that 17.8% of 12-17 year olds had used cannabis in their lifetime and 14.2% had used in the past year. In terms of lifetime use, in comparison with 1996, the prevalence of cannabis use had almost halved from 35% to 18%. A more detailed look at the pattern of use in 2005 for 12-17 year olds, not surprisingly, shows that the prevalence of lifetime use increases with age from 4.6% at 12 years of age to 32.4% by 17 years of age. Past year use also increased from 2.9% to 25.3% from 12 to 17 years of age respectively. According to the NDSHS [21], the mean age of initiation has not varied substantially in the past 10-15 years, ranging from a low of 18.5 years in 2001 to 19.1 years in 1995. In 2007, the mean age of initiation was 18.8 years. Overall trends in developed countries, suggest a decrease in the age of initiation to cannabis use and an extension of the ages for which there is a risk of cannabis initiation beyond the adolescent years [64].

When we examine types of cannabis use, in contrast to overall population trends (i.e., Australians 14 years and older), bongs (males 59%, females 58%) were more frequently used than joints (males 35%, females 38%) in this 12-17 year age range [41]; this does, however, vary depending on level of use, with occasional users being more likely to use joints than bongs. Adolescents were typically found to use cannabis with others, with a minimal number using cannabis by themselves. The majority of young people, who do use cannabis, are not regular users. At 13 years of age, 2% of males and females report regular use (i.e., having used cannabis at least 10 times in the past year). For males, regular use peaks at age 15 and over, with 9% reporting regular use of cannabis. For females, regular use peaks at age 16 years with 6% of students reporting having used cannabis 10 times or more in the past year. In general, males are more likely to be regular users of cannabis than females. World trends, however, suggest that this gender disparity in the prevalence of use, which is typical of cannabis use, is declining in the younger cohorts of drug users [2].

The use of cannabis in young people is of concern, as early initiation and regular use are associated with impaired mental health (e.g., depression, psychosis, dependence, subtle memory problems), delinquency, other illicit drug use, lower educational attainment, lower employment prospects and social outcomes, risky sexual behaviour, financial cost / hardship, and criminal offending. For those with a pre-existing heart problem there is also an increased risk of heart attack and stroke in the long term [1-3]. There are very few studies investigating cannabis-related mortality, largely because cannabis has not been shown to cause fatal overdose [65]. Recent research, however, has investigated the relationship between cannabis use and a number of fatal outcomes: culpable driving associated with fatal motor vehicle accidents, various cancers, and suicide attempt or completion [65]. The review revealed that there is insufficient evidence, largely due to the lack of research, to assess whether mortality in general is elevated in cannabis users. Case control studies suggest that some adverse health outcomes may be elevated among heavy cannabis users, namely, fatal motor vehicle accidents, and possibly respiratory and brain cancers. Clearly, cannabis use is associated with a number of outcomes that can have a deleterious effect on a young person's life potential and for this reason should be the focus of prevention efforts.

Psychostimulants

After cannabis use, psychostimulant drugs are the next most frequently used illicit drugs in Australia. In 2007, it was estimated that over 500,000 Australians aged 14 years or over had used psychostimulant drugs. Ecstasy was the most common psychostimulant, with a past year prevalence of 3.5%, followed by meth/amphetamine (2.3%), while the use of cocaine was comparatively less common (1.6%). The dominance of ecstasy use was amplified among teenagers, with 5% of 14-19 year olds having taken ecstasy in the past year, in comparison with 1.6% for methamphetamine and 1.1% for cocaine [62].

Over the past decade there has been a clear and persistent trend toward increasing ecstasy use, particularly among teenagers [62]. Methamphetamine use remains concerningly high by international comparison, but its use has declined markedly since 2004, especially among young adults, and as noted above, methamphetamine use among teenagers is now comparatively low [62]. Generally speaking, cocaine use has remained low and stable in Australia throughout this time, although a recent upward trend in its use may be an indication that psychostimulant use patterns could change in the future.

Given the greater likelihood of ecstasy and meth/amphetamine use compared to cocaine use, the decision was made to focus on these two drugs in the CLIMATE Schools: Psychostimulant and Cannabis Module. This more limited focus was important, because for prevention to be truly effective, it must be relevant and meaningful to the population in question [39]. The use of cocaine in the younger age groups was so low, that focusing on this drug would not have provided a relevant or meaningful message. This focus, however, may need to change in the future, depending on the changing patterns of psychostimulant use.

Meth/amphetamine

In 2007, 6.3% of Australians over the age of 14 years reported lifetime use of meth/amphetamine and 2.3% reported using the drug in the past year [62]. The average age of initiation is 20.9 years. The majority of those who reported using meth/amphetamine only used it once or twice per year (37.7%). A significant percentage, however, use it daily or weekly (14.2%). The most frequently used form was powder (51.2%), followed by crystal (26.7%) and then base (12.4%). In this general population sample, the usual source of the drug was from friends and acquaintances (65.9%). Twenty-seven percent also reported that they usually obtained methamphetamine from a dealer. The four most common places reported for usual use of methamphetamine were 'in a home' (67.8%), 'at private parties' (50.3%), 'at a public establishment' (38.3%), and 'at raves/dance parties' (37.4%). The three drugs most commonly used with meth/amphetamine were alcohol (80.8% of persons), cannabis (62.8%) and ecstasy (53.0%). These high rates of polydrug use in this sample also pointed to the importance of covering polydrug use as an issue in its own right in the CLIMATE Schools: Psychostimulant and Cannabis Module.

Meth/amphetamine use in young Australians

The majority of adolescents aged between 12 and 17 years of age have never tried meth/ amphetamine (94.7%). Of those who have, 4.2% reported past year use and 2.4% reported past month use. Use of meth/amphetamine in the past year increased from 2% using at age 12, through to 6.4% at age 16. This figure declined to 5.4% by the age of 17. For those who did use meth/amphetamine in the past year, the regularity of use was quite infrequent; 39% of males and 48% of females had used only once or twice. Only 1% of students indicated that they used meth/amphetamine regularly [41]. White and Hayman [41] conclude that the pattern of results found in the survey suggests that there is a low level of experimental use among secondary school students, with only few students having used meth/amphetamine recently.

The uptake of methamphetamine use among teenagers can lead to ongoing abuse and/or dependence and a consequential cascade of ill-effects on health and social functioning throughout adulthood. Adverse psychological effects include meth/amphetamine-induced psychosis [66], as well as violent and aggressive behaviour reflected by an increased proportion of property damage [67]. Adverse physical effects include an elevated risk of haemorrhagic stroke [68]. In addition, methamphetamine use is associated with cardiovascular problems, the most common of which are tachycardia (a rapid increase in heart rate), hypertension (an increase in blood pressure), and heart palpitations (see [69] for review). These effects tend to subside when intoxication ceases; however the cardiovascular effects of methamphetamine use can be life threatening, even in experimental users, for two reasons. First, pre-existing cardiac conditions may be exacerbated by meth/amphetamine use [70] and, given that many cardiac conditions do not come to light until later in life, this places young meth/amphetamine users with undiscovered cardiac pathology at particular risk of serious cardiac complications. Secondly, no clear dose-dependent relationship exists between methamphetamine use and fatal cardiac events [71]. Clearly, other factors that are not yet properly understood may mediate the risk of death, meaning that even experimental use may be a cause for concern. In the context of Australia, between 2000 and 2005 there were 371 deaths associated with meth/amphetamine use. This was found to be a clinically significant number of fatalities, and in the majority of cases meth/amphetamine was used alongside additional illegal substances [71]. Clearly, any program that attempts to address meth/amphetamine use in Australian adolescents must also address polydrug use, as well as increasing knowledge regarding the various psychological and physical harms associated with use.

Ecstasy

Results from the 2007 NDSHS showed that for persons aged 14 years and older in Australia, 8.9% reported having used ecstasy in their lifetime and 3.5% in the past 12 months [62]. Males were more likely to have used ecstasy in their lifetime than females. The majority of people who did report that they had used ecstasy in the past year did so infrequently, with 46.0% reporting having used once or twice a year, 28.9% reporting use every few months, and 16.8% reporting use about once a month. Eight point three percent reported regular daily or weekly use of ecstasy. The usual source of ecstasy for the majority of people was from a friend or acquaintance (72.2%), with one in five obtaining ecstasy from a dealer. Ecstasy was typically used 'at raves and dance parties' (60.5%), 'at public establishments' (52.2%), at 'private parties' (53.5%) and 'in private homes' (48.2%). Like meth/amphetamine, ecstasy is also often used in conjunction with a number of other drugs. Specifically, the following percentages of people reported using the following drugs at the same time as ecstasy on at least one occasion in the last year; alcohol 86%, cannabis 49.2%, meth/amphetamine 28.7% and cocaine/crack 18.5%. The drug most likely to be used when ecstasy was not available was alcohol.

Ecstasy use in young Australians

Ninety-six percent of young Australians aged 12-17 have never used ecstasy, 3.25% have used in the past year, and 1.7% in the past month [41]. Past year use of ecstasy increases with age; 1.2% of 12 year olds report using in the past year, rising as high as 5% for 17 year olds. The regularity of ecstasy use in young people is infrequent. That is, of the 3% who did report using ecstasy in the past year, 36% of males and 59% of females had used it once or twice. Less than 1% of all students had used ecstasy 10 times or more in the year before the survey. Over the period from 1996 to 2005 there have been no significant changes in the number of young people using ecstasy in the past year. The patterns of use exhibited also suggest that when use does occur, it is largely experimental.

Ecstasy use by young people is of considerable concern. Although the incidence of serious acute adverse events related to ecstasy may be relatively low, when they do occur they are unpredictable and are associated with considerable rates of morbidity and mortality [72]. Until recently it has been thought that the adverse effects of ecstasy are largely a result of the combination of the dose, setting and individual behaviour. Specifically, ecstasy use can result in hyperthermia (i.e., a recorded body temperature greater than 38 degrees Celsius), and of 48% of identified cases of ecstasy-induced hyperthermia, death was the outcome. Hyponatraemia (i.e., where the sodium concentration in the plasma is lower than normal) is another possible adverse effect caused by ecstasy use and has also been shown to result in death. The cause of the hyponatraemia from ecstasy use is postulated to be from the combination of a user consuming excessive water and the release of a hormone which has an antidiuretic effect. Given that many young people consume ecstasy in the 'dance party' scene, where the ambient temperature is higher, it is crowded and the predominant activity is dancing, it is assumed these contextual factors can act to enhance the negative outcomes that result from ecstasy use. A recent large-scale review of ecstasy-related fatalities in Australia (2000-2005), however, has found that the majority of ecstasy-related deaths actually occurred in the family home, and of 82 cases of MDMA-related deaths only one documented case was due to hyperthermia [73]. The very important message from this review was that the concerns related to the use of ecstasy use should extend to all ecstasy users, irrespective of the context of use. This study revealed that in a five year period, there were 82 cases of ecstasy-related death in Australia, which is clinically significant. Although a significant number of these deaths were related to ecstasy toxicity alone, the majority resulted from combined drug toxicity, which is a pattern typical of ecstasy users. The resulting deaths were also not directly related to dose, suggesting that even small quantities may be of concern. These results highlight the potential harms from ecstasy use, but also show that it is essential for any program targeting ecstasy to also address the risks associated with polydrug use.

In summary, for those young Australians who do use drugs, there is potential for considerable harm. The potential for such harm is even further elucidated by research which shows that drug use during adolescence places a young person at greater risk of developing a substance use disorder later in life.

Early initiation to drug use: A risk factor

Considerable research has demonstrated that the early onset of drug use is associated with an increased risk of developing a substance use disorder in later life [74-81]. A recent 10-year German longitudinal study [81] of a sample of 3,021, community subjects aged 14-24 years, investigated the relationship between age of onset of drug use (alcohol, cannabis and tobacco/nicotine use) and the development of a substance use disorder in later life. In addition to this, it extended the research further by examining the relationship between the age of onset of these drugs and the speed of transition to developing a substance use disorder. The results once again confirmed that early onset of drug use was a risk factor for the development of a substance use disorder, but later onset was a risk factor for the more rapid transition to a substance use disorder (with the exception of cannabis dependence). These results show that early onset does not necessarily mean that an adolescent is at increased risk of a rapid transition. In this study, the speed and pattern of transition to a substance use disorder was different for the three drugs. Specifically for cannabis, the transition to cannabis abuse and dependence occurred more rapidly than transition to alcohol disorders and nicotine dependence. Conditional disorder rates (i.e., early onset leading to a disorder), however, were smallest for cannabis. For alcohol, a higher risk and a lower speed of transition to alcohol use disorders was found in those with an early onset of alcohol use. For later onset, the transition was considerably faster, a finding which was attributed to the following possible factors: (1) co-occurrence with other substance use, (2) more intense patterns of drinking, (3) less alcohol-related parental control, and (4) greater opportunities to obtain alcohol. The development of nicotine use revealed a similar pattern of findings, and the authors attribute the faster transition to dependence in later adolescence as a possible result of: (1) higher social acceptance of nicotine use, and / or (2) more opportunities for regular smoking in later adolescence. For both nicotine and alcohol, later onset concurrent with other substance use leads to an increased risk of developing a substance use disorder, and for alcohol, a faster transition to alcohol dependence.

This research has important implications for prevention. It highlights the importance of intervening early before drug use is initiated, but it also gives the clear message that delaying initiation is not sufficient to reduce the risk of later dependence. For cannabis use prevention, it elucidates even further the need to begin early, because if a substance use disorder were to develop, a cannabis use disorder will occur faster in comparison with disorders associated to the other two drugs. For alcohol, the window of opportunity is clearly greater, but prevention efforts need to be ongoing since those who initiate at an older age are at risk of a faster transition. This research demonstrates that the transition phase is critical to prevention because it also has implications for the other factors which need to be targeted to develop an effective substance use prevention program. Currently, the most common and practical venue for implementing such prevention programs for drug use is in schools [29].

School-based prevention

School has considerable potential as a location for the implementation of universal programs for the prevention of alcohol and other drug misuse [4, 27, 29, 82, 83]. Young people spend greater than 25% of their waking lives attending school, allowing educators the ability to reach large numbers of youth at a time when many are just beginning to experiment with tobacco, alcohol, cannabis or other illicit drugs [4, 26-29, 82]. The classroom is also the location of a great deal of peer interaction which is a significant risk factor for drug use and is a nominated avenue for intervention in the more successful drug prevention programs [84-86]. Attendance at school is mandatory, which helps to ensure that students receive the majority of the content of prevention programs [32, 85]. Most young people also attend school continuously from early childhood through to late adolescence, allowing educators to tailor the prevention message to different developmental and social stages [33, 87]. The ability to capture the majority of young people in a single setting also helps to minimise the costs of prevention [31]. Admittedly, school-based prevention programs do not reach all young people. Evidence shows that the youths who drop out of school are those who are frequently absent and are generally those at higher risk for developing problematic patterns of alcohol use [32, 88]. Nevertheless, few venues exist other than school where there is a common forum to reach youth and most young people who do drop out of school are at a point where they need intervention or treatment rather than prevention [88]. Overall, school-based prevention has substantial practical and economic advantages, which is recognised by the fact that school-based drug prevention is made part of the educational curriculum in most Western countries [15, 89].

The next chapter will provide a review of the different approaches which have been taken to school-based drug prevention and highlight the approaches which have been found to be more effective. It will also provide a review of the factors which have been identified that compromise the efficacy of programs and provide a discussion of potential avenues for increasing program efficacy.

CHAPTER 3: EVIDENCE-BASED PREVENTION[3]

What constitutes an effective drug prevention program?

Although drug education programs have been in existence since the late nineteenth century, formal evaluations of such programs did not commence until the mid 1960s [90]. When the evaluation of drug education programs first began, the main focus was on changing knowledge and attitudes [19, 34, 84]. It was soon realised that change in knowledge and attitudes did not necessarily result in behavioural change [91, 92]. The demonstration of behavioural change was and is considered to be essential [7, 19, 28, 33, 36, 93-96]. The main goal of behavioural change is to alter the otherwise predicted course of development, which is either to suppress drug use behaviour or keep it from occurring [97].

The content and delivery of drug prevention programs has also changed over time and, for simplicity, can be broken down into five category types: information, affective, alternative, social influence, and comprehensive programs. In reality these categories are not as clear cut, with many programs being quite eclectic in content [18, 98] and the vast majority (91%) [99] having an informational component. The least effective of these five program types are the information, affective and alternative programs. For this reason, they will only be briefly reviewed. A more comprehensive review of social influence and comprehensive programs will be provided as research has demonstrated these to be the more effective program types.

Information, affective and alternative programs

Information based programs, which assume drug use is based on a rational model, assume that the provision of factual information on patterns of drug use and the social, legal and health consequences [13, 19, 95, 100] will give a young person the knowledge needed to choose not to use drugs. These programs, however, typically increase students' knowledge, but fail to alter attitudes or change drug use behaviour [13, 28, 29, 84, 94, 95, 100-103]. While information dissemination is recognised to be important, in isolation from other approaches it is not enough to produce change in such a complex behaviour as drug use [42].

Affective programs are based on the assumption that young people use drugs because they lack the personal and social skills to resist them. The aim of these programs is to help young

[3] Sources for Chapter 3:

Chapter 3 is a brief summary of school-based drug prevention taken from Chapter 2 of the following document:

> Vogl, L. E. (2007). CLIMATE Schools: Alcohol Module - The feasibility and efficacy of a universal school-based computerised prevention program for alcohol misuse and related harms. Unpublished PhD, University of New South Wales, Sydney.

people to build self-esteem and develop personal and social skills which will enable them to have their own values and attitudes, and in turn make good health-related decisions -more specifically, to make decisions to avoid the use of drugs [13, 18, 19, 28, 29, 94, 104]. The information and skills provided in these programs are not always directly linked to drug use. Evaluations of alternative programs show that they have little impact on changing knowledge, attitudes or drug use behaviour. These programs also fail to make an impact on decision making, assertiveness and communication skills [4].

<u>Alternative programs</u> aim to get young people involved in alternative activities (e.g., tutoring, Outward Bound courses), which in turn is thought to prevent or decrease drug use through one or more of the following mechanisms (1) building their self-esteem, making them feel positive, reducing boredom and alienation and increasing self-reliance; (2) simply providing an alternative activity to drug use, and (3) providing a healthier alternative activity which could fulfil or mimic the pleasurable or desirable effects of drug taking (e.g., parachuting to fulfil the desire for risk-taking or sensation seeking behaviour) [13, 94, 104, 105]. Unfortunately, like affective programs, alternative programs have also failed to show any impact on drug use in universal prevention programs [4, 13, 94, 104, 105]. With targeted populations, however, alternative programs have shown great promise in increasing skills and reducing drug using behaviour. Although these programs are intensive and costly, they do improve the behaviour of a highly treatment resistant group of young people [94].

In contrast to information, affective and alternative programs, the school-based universal drug prevention programs which do show promise in changing drug use behaviour, importantly recognise and address the external social pressures which influence young people's decision to use drugs. These more effective programs are strongly founded on theories of human behaviour [13]. The prominent theories which have influenced the development of these programs include Bandura's Social Learning Theory [106], McGuire's Theory of Persuasive Communication [107], and Ajzen and Fishbein's Theory of Reasoned Action [108], all of which recognised the importance of psycho-social factors. These theories also recognise the importance of both real and perceived social influences in conjunction with providing a greater understanding of how prevention messages can be convincingly conveyed. These theories led to a new group of drug prevention programs called 'social influence programs'.

Social Influence

Social influence programs emerged in the early 1980s and recognise the importance of social influences in the initiation of drugs [28]. Specifically, these programs are based on the notion that young people initiate drug use as a result of external and perceived pressure from peers, the media, adults and the whole of society [101]. They also assume that young people are not adequately equipped with the skills to accurately recognise and resist such pressures. Hence, these programs contain three important components: information, drug resistance skills and normative education [13, 15, 19].

The most important component is normative education. Normative education involves presenting young people with accurate, conservative norms regarding peer drug use, with the aim of decreasing the perceived prevalence and acceptability of drug use. The reason this is so important, is because young people often perceive the prevalence of drug use amongst their own age group to be far greater than what it actually is in reality. As adolescence is a time when young people want to fit in with their peers, this erroneous perception can result in young people deciding to use drugs themselves. Normative data is either collected from population or class surveys and is fed back to students as a means of correcting erroneous beliefs regarding peer drug use. The drug resistance skills component aims at increasing young people's awareness of social pressures to use drugs (e.g., peers and mass media) and teaching skills to resist such pressures while still maintaining their friendships [101]. In the information component, the information which is provided emphasised the short-term (e.g., having bad breath, feeling paranoid) rather than the long-term (e.g., cirrhosis of the liver, heart failure) consequences of drug use. This feature of social influence programs is more commensurate with the thinking style and experiences (e.g., alcohol-related illness, academic failure, unreliability) of the teenage years [18, 38, 109].

The importance of social processes in the onset of drug use has also been recognised in the delivery style of social influence programs. Such programs are characterised by far more active, participatory learning experiences that include group work, discussion, role-plays and modelling. It is frequently the case that same age or older peers assist with the delivery of such programs [19, 28, 29, 101]

In contrast to the efficacy of information, affective and alternative programs, social influence programs have been found to be effective in increasing drug-related knowledge and decreasing pro-drug attitudes [7, 96, 110]. The evidence concerning the impact of social influence programs on behaviour is less clear. In a meta-analysis conducted by White and Pitts [7] of 55 school-based drug prevention programs they found that behavioural change was only demonstrated in 27% of studies. In contrast, Hansen [99] reviewed the literature from 1980 to 1990 and found that 51% of social influence programs demonstrated positive changes in drug use behaviour. This result was further improved to 63% once studies with questionable designs were eliminated. In meta-analyses by Tobler and Stratton [19] and Tobler et al. [18], they have found that the effect size on drug use behaviour for social influence programs varies between 0.14 and 0.19 standard deviations and that such effect sizes are significantly greater than zero. This suggests that although effect sizes are small, social influence programs have the capacity to impact on drug use behaviour [15]. The evidence, however, suggests that without ongoing intervention these effects gradually decay over time [7, 111].

Many reasons have been proffered to explain the varying success of such programs, the first of which is the inclusion or exclusion of active ingredients or components of social influence programs. The normative education component of drug education programs has been found to be extremely important, if not essential [4, 6, 28, 29, 85, 96, 112-116]. Programs, which omit such a component, have often been met with a lack of success in decreasing drug use behaviour. In addition, programs that include resistance skills education, but fail to include the normative education component, have been shown to increase drug use in some studies [114, 117, 118]. The possible reason given for this iatrogenic effect is that teaching young people resistance skills without providing conservative drug norms may actually communicate to young people that they need such skills because the prevalence of drug use is high. Hence, such programs may erroneously create an increased perception of drug use and consequently increase the perception of its acceptability among peers.

Social influence programs also assume that young people use drugs because they either succumb to persuasive messages or lack effective resistance skills [29]. Social influence programs fail to take into account that some students may want to use drugs for instrumental reasons [13]. For example, a young person may take drugs to deal with depression, anxiety or to escape from feelings of low self-esteem. Clearly, to increase the efficacy of drug prevention programs, the programs needed to be more comprehensive and cater for a broader array of aetiological risk factors. This recognition led to the advent of comprehensive drug prevention programs, otherwise known as competence enhancement programs [13].

Comprehensive Drug Prevention Programs

These programs are based on Bandura's Social Learning Theory [106], McGuire's Theory of Persuasive Communication [107], and Jessor and Jessor's Problem Behaviour Theory [119] which investigates the more complex array of risk factors for problem behaviour. According to this conceptualisation, drug use is a socially learned and functional behaviour that is the result of the interplay between biological, environmental, family, economic and behavioural domains.

Comprehensive drug prevention programs combine the social influence components with the teaching of personal and social skills (e.g., communication, assertiveness, coping, decision making, problem solving, goal setting, anger management, adaptive coping strategies for dealing with anxiety and depression, and self-esteem building) [4, 13, 18]. Since previous evidence had suggested that teaching personal and social skills without direct application to drugs was ineffective (affective programs), the direct link was also made in these programs between these skills and actual drug use [4, 13, 120]. Importantly, the style of delivery of comprehensive prevention programs is highly interactive, involving class discussions, instruction and demonstration, practice, group feedback and reinforcement, behavioural rehearsal, and home practice [13]. Evaluations of comprehensive programs have shown that this interactive style of delivery is essential to the success of such programs. Content alone is not sufficient to achieve behavioural change [19]. Specifically, the Drug Awareness Resistance Education (DARE) which is widely disseminated in the United States has the content of a comprehensive drug prevention program, but has been shown to be ineffective. This lack of efficacy has been attributed to both the use of a didactic delivery style and use of a police officer as the trainer, as well as a greater concentration on intrapersonal, rather than interpersonal skills development [18, 96].

In terms of efficacy, comprehensive drug prevention programs are effective in decreasing tobacco, alcohol, cannabis and polydrug use [13, 31]. In a review by Hansen [99] which investigated the percentage of good quality studies that impacted positively on drug use behaviour, 72% of studies were positive, 28% were neutral, and none were negative. Although the percentage of positive behavioural outcomes appears impressive, meta-analyses conducted by White and Pitts [96], Tobler et al. [18] and Tobler and Stratton [19] showed that the overall effect sizes were small (0.24) and were found to decline with time. In addition, the comparative effectiveness of these programs over social influence programs has not been established. In a series of meta-analyses conducted by Tobler and Stratton [19] and Tobler et al. [18], comprehensive drug prevention programs were found to have higher effect size than social influence programs, but not significantly so. In addition, any advantage of comprehensive programs over social influence programs was only evident if the programs were run in smaller group settings [18].

One strategy that appears to improve the efficacy of comprehensive and social influence programs (although again not significantly) is to add a community-based component to the intervention [18, 96, 111, 121, 122]. Such programs are called ‘system-wide change programs’ or ‘community prevention programs’. These programs consist of the standard school-based intervention, supported by community programs, media and family involvement, and a change in the entire school system and policies [18, 123-126]. Community units include businesses, the media, the family and governmental agencies (such as police or recreational departments) as well as school systems [127]. These programs are generally coordinated by an external organisation or task force [125, 126]. In a meta-analysis conducted by Tobler et al. [18], these programs have demonstrated slightly larger effect sizes on drug use behaviour (ES=0.27) than both social influence and comprehensive programs, but have the disadvantage of being costly and resource intensive to implement and sustain [110].

Summary

The most effective school-based drug prevention programs are the social influence programs, comprehensive programs and those which are delivered as part of a community-wide approach. These programs have all demonstrated significant small effect sizes in the short term, with less evidence to suggest such program effects can be sustained in the long term without continued intervention [7]. Although significant criticism has been levelled at school-based drug prevention as a result of the small effect sizes and short term impact [5, 6, 8], these results do not support abandoning the pursuit of school-based drug prevention.

Drug use is determined by a multitude of different factors and for this reason it is not realistic to expect large effect sizes for school-based programs [128-131]. School-based programs ideally need to be part of a larger community-wide approach which has the capacity to impact on more distal influences in the broader social environment. To date, however, such community programs have been unable to demonstrate significant impact over and above the school-based education component [18, 111] and have the disadvantage of being costly and difficult to implement [18, 110].

The capacity of one-off school-based interventions to demonstrate sustained behavioural changes over time is also not realistic [132, 133]. Factors that influence drug use behaviour change with different developmental stages and experiences, suggesting the need for ongoing prevention efforts which address factors which are relevant at the time. It makes sense, that the inclusion of ongoing interventions over the years will improve the long-term effects of a program by addressing different developmental requirements [7, 31, 33, 45, 134]. The importance of ongoing intervention was particularly evident in an evaluation of a community-wide intervention program: Project Northland [135]. In this evaluation which occurred over a seven-year period, it was found that in each year an intervention was implemented, substance use behaviour was significantly less in the intervention group compared with the control. However, for two of the years in the middle of the study where no intervention was implemented, there was no difference between the groups. This led the authors to conclude that it is critical that interventions are planned and implemented throughout adolescence.

Clearly, the social influences on adolescent drug use behaviour are far too strong for school curricula to be highly effective on their own or without continued intervention [111]. The current state of affairs emphasises the need for ongoing research to establish the most effective school-based curricula, school-wide environmental change, parent training program, and community and media approach. Until that time, it is not possible to recommend any programs that combine two or more of these approaches for the prevention of substance use [36, 111]. This emphasises the importance of not abandoning school-based drug prevention, but working towards more effective programs. Hence, the goal of improving the overall efficacy of school-based drug prevention represents an important avenue of pursuit. Two areas of consideration for this pursuit are (1) improving program implementation, and (2) broadening the focus from only abstinence-based goals and outcomes to a harm-minimisation approach. Both these areas have previously been identified to potentially compromise the effectiveness of school-based drug prevention outcomes and will be addressed in the following sections.

Constrained outcomes: Zero tolerance versus harm-minimisation

Reviews of school-based drug education [7, 28, 93, 96, 136, 137] note that the majority of evaluations included in their reviews / meta-analyses are conducted in the United States. In the United States, the National Drug Control Strategy emphasises a zero-tolerance approach to drug education in schools [27, 138]. This strategy does not consider harm-minimisation as a goal [27]. Proponents of the zero-tolerance approach argue that the early onset of alcohol use places a young person at greater risk of developing an alcohol or other substance use disorder [125, 138, 139]. For this reason, proponents fervently focus prevention efforts on the goals of non-use or delayed use [138, 139]. They also argue that adolescents are not cognitively mature enough to understand complex harm-minimisation messages, or put them into practice. Abstinence-based messages are simple and straight forward to teach and require fewer less sophisticated psychosocial skills to achieve [129].

There are a number of premises, however, where the arguments for a pure zero-tolerance approach break down. First, assuming that abstinence-based programs did have the capacity to delay the onset of drug use, there is currently little evidence to support the notion that for the majority of drugs this delay leads to more controlled use later in life [7]. In fact, later onset of some drugs has been found to be a risk factor for the more rapid transition to a substance use disorder (with the exception of cannabis dependence). This research highlights the importance of getting in early before drug use is initiated, but it also gives the clear message that delaying initiation is not sufficient to prevent later dependence. In addition, drug use is multiply determined and delaying the onset of drug use may mean young people find other harmful means of engaging with peers.

The use of drugs does not always lead to bad outcomes [139, 140]. Evidence does suggest that the early onset of drug use leads to greater risk of dependence and abuse, but it is equally true that a large proportion of adolescents who do try alcohol or other drugs will cease using such substances by their early to mid-20s [25, 76]. There is also evidence to suggest that those adolescents who do experiment with drug use may have better social and emotional adjustment than those who abstain [139-141]. Very importantly, drug prevention programs which focus solely on abstinence-based messages are of little assistance to the many young people who have already tried alcohol or other drugs [45]. Programs with abstinence-only messages fail to equip young people who do choose to use alcohol and other drugs with knowledge and skills on how to cope with drug-related situations, leaving them to develop their own such knowledge, or to seek information from inaccurate sources [45].

There is also evidence, with alcohol prevention programs in particular, that the measurement of only abstinence-based outcomes may provide misleading results regarding the effects of prevention [142]. Specifically, while prevention programs may elicit some curiosity and lead to increased experimentation, they may actually decrease harmful levels of alcohol use. In a study by Williams et al. [143], a greater proportion of students exposed to an alcohol intervention reported having tried alcohol, but the frequency of consuming alcohol to intoxication was significantly less than in the control group a year after the intervention. A narrow focus on abstinence-based outcomes can therefore obscure positive program effects [34, 90]. The adoption of a harm-minimisation framework, on the other hand, has the capacity to recognise such positive program effects, whilst also promoting abstinence as a sought after outcome.

The harm-minimisation approach

The genesis of the harm-minimisation approach comes about from a pragmatic recognition of the ubiquitous nature of drug use in many societies [144-147]. Proponents of the harm-minimisation approach do not believe that a purely abstinence-based approach, which aims to rid society of drugs, is realistic or compassionate [144, 146]. The harm-minimisation framework moves away from focusing entirely on the complete eradication of drug use; rather, it attempts to minimise or prevent the consequences or effects of alcohol and other drug use on both the individual and society [27, 146, 147]. Harm-minimisation does not exclude abstinence as a desirable outcome, but views it as one of many desirable outcomes to prevent or minimise drug-related harms and consequences [27, 144, 147]. In terms of drug use, other desirable behavioural outcomes include decreasing the frequency and quantity of use, decreasing the frequency of drinking to intoxication and the experience of alcohol-related harms (e.g., physical fights, sexual assaults, getting in trouble, being a passenger in a car driven by an intoxicated driver) [34, 147]

The capacity to use a harm-minimisation approach with alcohol is possibly easier than using it with other drugs because alcohol use is more socially acceptable. With alcohol in particular, many teachers and young people do not believe that it is possible to support abstinence-based education in the current culture [148]. Unlike tobacco and illicit drugs, the consumption of alcohol is a highly socially acceptable practice and its use is widespread, placing any abstinence-based message at odds with what is happening in society [34, 92, 129, 149]. Therefore, successful prevention may require some level of societal disapproval or young people will view such messages as hypocritical [139, 150].

Using a harm-minimisation approach for the prevention of alcohol misuse

Very few alcohol prevention programs exist with an explicit harm-minimisation framework [110]. Two such programs which explicitly teach harm-minimisation skills are the School Health and Alcohol Harm Reduction Project (SHAHRP) [110, 151] and the Alcohol Misuse Prevention Study (AMPS) [85, 132, 134, 152]. AMPS has been extensively implemented and evaluated [85, 134, 153-155]. Although, in the majority of evaluations the program has not been found to alter actual alcohol consumption, it has demonstrated the capacity to decrease alcohol-related harms in students with prior alcohol exposure which has occurred in unsupervised settings. Such effects have not been found for students who are initially abstinent or just drink with adults in supervised settings. These studies have generally been conducted in the early adolescent years (i.e., 10-12 years of age). The inability to observe program effects in the entire sample has been attributed to the difficulty in observing effects when the prevalence of such behaviours in students of this age is low. An evaluation of AMPS in Year 10 students lends support to this explanation because it was possible to demonstrate a reduction in harms in the whole sample in this older age group [134]. This inability to detect differences due to the low prevalence of alcohol consumption may have been further exacerbated by only including students in the analysis who had a complete data set for all follow-up occasions. This would most likely screen out students who were consuming alcohol at higher levels since they would typically be more likely to be absent from school [19, 110, 112, 132, 150, 155-164]. The capacity for students with prior exposure to alcohol in unsupervised settings to change their behaviour has also been attributed to the ability of such students to better relate and benefit from program content because they have had prior exposure to alcohol-related situations. Implementation of the AMPS program [154] in Year 10 of secondary school has also led to significant decreases in serious driving offences (including those which are alcohol-related) up to one year after the intervention. In this case program effects were actually stronger for those students who consumed less than one drink per week prior to the intervention.

The SHAHRP program is of particular relevance because it was conducted in Australia [110, 151]. The aim of this program was to reduce the harm that young people experience as a result of their own alcohol consumption and other people's use of alcohol. The SHAHRP program consists of a core program in Year 8 of high school (12–13 years of age) followed by an extensive booster program in the following year. The results of the SHAHRP intervention, which can be seen in Table 1, demonstrate that a harm-minimisation intervention can effectively decrease consumption and related harms.

Table 1: Overall summary of the results of the SHAHRP intervention

	Design and measurement occasions					
	Baseline	Core program	Post 1 (five mths months post core program)	Booster (12 mth post core program)	Post 2 (5mth post booster)	Post 3 (12 mth post booster)
Outcome Measures						
Knowledge			*		*	NS
Attitude			*		*	*
Total consumption			*		*	NS
Frequency of consumption			*		*	NS
Quantity consumed per occasion			NS		*	NS
Proportion consuming alcohol to excess**			*		*	*
Context			Less risky		Less risky	Less risky
Harm – own alcohol consumption			*		*	*
Harm – others alcohol consumption			NS		NS	NS

***** Indicates that the SHAHRP intervention demonstrated significant positive prevention effects in comparison with the control on this follow-up occasion
** Excess alcohol consumption is defined as greater than four standard drinks for males and two standard drinks for females
NS – Not significant

SHAHRP was effective in increasing knowledge and decreasing pro-drug attitudes. In terms of behavioural change, the SHAHRP program effectively decreased the amount of alcohol consumed in the past 12 months, decreased the frequency and quantity of consumption per occasion and decreased the harms students experienced as a result of their own alcohol consumption. Most behavioural effects were evident five months after each phase of the intervention, but once a 12-month gap had arisen since the last intervention component, the effects on alcohol consumption measures such as total consumption, frequency and quantity diminished. Significant improvements remained in the intervention group 12 months after the booster session for the number of students who reported drinking to excess and for the harms students experienced as a result of their own consumption. The results of the SHAHRP intervention clearly demonstrate that young people do have the capacity to learn, process and practice harm-minimisation skills.

The SHAHRP program did not demonstrate any effects on reducing the number of harms young people experienced as a result of other people's drinking. Three possible reasons may account for this lack of effect. First, the prevalence of harms resulting from others' alcohol consumption was low, making it hard to detect intervention effects. Secondly, the harms may be a result of interactions with adults. Often young people have little control over their own destiny in these interactions. Finally, one item on this scale asked students to rate how many times they helped a friend from getting into trouble. As a harm-reduction program this may actually be considered as a positive outcome and have erroneously inflated scores on this scale.

Two further programs with an explicit harm-minimisation approach have also been found to be effective in decreasing the frequency of drinking to intoxication [143] and the occurrence with which young people travel in a car with a driver who has been drinking alcohol [92]. There are also a significant number of other studies which have assessed the effectiveness of a school-based alcohol prevention program in terms of a broader array of harm-minimisation outcomes, without the program explicitly coming from a harm-minimisation framework. The evidence from these studies is promising. The collective evidence demonstrates that school-based alcohol prevention programs can decrease the proportion of students who become intoxicated [31, 112, 115, 165-167] and the frequency in which they participate in this behaviour [31, 43, 110, 112, 120, 143, 158, 159, 164, 168-171]. School-based alcohol prevention programs can also decrease the frequency [110, 120, 132, 159, 164, 168, 170-172] and quantity [110, 120, 132, 159, 168, 169, 171] of alcohol consumption by young people and decrease polydrug use [159]. School-based alcohol prevention programs have also demonstrated the capacity to decrease acute harms that young people experience from alcohol consumption [85, 92, 110, 115, 132, 134, 153-155, 164, 173, 174].

Particularly noteworthy is a series of studies conducted by Ellickson et al. which evaluated Project Alert [150, 161, 162]. This program was specifically designed as an abstinence-based drug prevention program. In the early evaluations of Project Alert, reflecting the zero-tolerance approach to alcohol prevention, the prevalence of alcohol consumption over different time intervals was the only outcome measure considered. The students were divided into three user groups: non-users, experimenters (i.e., consumed alcohol less than three times per year), and alcohol users (i.e., consumed alcohol greater than three times per year and within the last month). Two intervention conditions were included, where one was led by a peer and the other by a health educator. The impact on alcohol consumption was limited and the effects rapidly dissipated. In light of the social acceptability of alcohol use, the authors revised Project Alert [163] to develop a harm-minimisation program which addressed alcohol misuse. This program was increased in length by three sessions to incorporate additional education on alcohol misuse. This change of focus resulted in the program effectively decreasing alcohol misuse 18 months after the intervention was delivered. Specifically, the program was found to significantly decrease harms associated with alcohol use (e.g., getting sick, getting in a physical fight, getting into trouble at school, getting into trouble at home and doing something they later regretted). Students who received the program also showed a tendency to decrease high-risk drinking (i.e., binge drinking, weekly drinking and poly-drug use). The addition of information and skills to curb alcohol misuse was effective and lends further support to the potential efficacy of harm-minimisation programs. There is, surprisingly, also evidence for harm-minimisation effects from drug prevention programs (e.g., Project Northland and Skills for Adolescence) based purely on a zero-tolerance approach, that even these programs have the capacity to decrease excess alcohol use and related harms [165, 175] whilst not always impacting on prevalence of students who consume alcohol [165].

The results of all these studies are promising and suggest that a harm-minimisation approach may be more effective for the prevention of alcohol use. These studies also indicate that the complete reliance on abstinence-based measures may be masking other clinically and statistically significant prevention effects. The strength of the conclusion which may be drawn from these studies, however, is marred by a number of methodological concerns inherent in some of these program evaluations. Such methodological concerns include: (1) high rates of attrition [31, 132, 134, 155, 176, 177]; (2) non-randomisation of conditions [134]; (3) lack of baseline measures [164]; (4) limited short-term follow-up [164, 169, 170]; and (5) individual rather than school level analysis [169, 170].

Notwithstanding the potential methodological concerns, alcohol prevention programs based on a harm-minimisation approach do show promise as a way forward for alcohol prevention with young people in schools. What is less clear is how acceptable or effective such an approach would be with school-based drug prevention programs for illicit drug use. Proponents of the zero-tolerance approach argue that a harm-minimisation approach is not appropriate for school-based drug prevention education as it condones illegal behaviour [125].

Using a harm-minimisation approach for the prevention of illicit drug use

A review of school-based drug prevention programs for illicit drug use found that in comparison to the usual curricula, social influence and comprehensive programs were, in general, effective in significantly reducing cannabis use and other illicit drug use [89]. The outcomes of interest in this review were 'reducing the incidence of first use' and 'reducing the prevalence of users'. The outcomes typically reflect an abstinence-based approach to prevention.

Unlike alcohol prevention programs, only one study, which was not included in the above review, explicitly adopted a harm-minimisation approach for the prevention of illicit drug use. Specifically, The Marijuana Education Project, conducted in Western Australia by Hamilton et al. [178] between 2002 and 2004 compared the efficacy of a harm-minimisation program with an abstinence-based program. The reported outcomes of interest were changes in the prevalence, frequency and harms associated with cannabis use. Unfortunately, to date, the outcomes of this research have not been published.

The majority of school-based illicit drug prevention programs are underpinned by an abstinence-based approach [98, 137, 160, 179-181]. There are, however, a number of other studies which have assessed the effectiveness of a school-based illicit drug prevention program in terms of a broader array of harm-minimisation outcomes, but which do not explicitly state whether they come from a harm-minimisation or an abstinence-based framework [158, 159, 170, 182-185]. The dearth of studies using harm-minimisation outcomes does not only reflect a concern with a harm-minimisation approach to illicit drug use in schools. Rather, because the prevalence of illicit drug use is substantially lower than alcohol use, it is difficult to show any behavioural prevention effects [159]. Hence, researchers are forced to use prevalence of use as an indicator, since it is hard to examine differences in the frequency, quantity and harms associated with use in smaller groups. A number of strategies have been used to overcome this problem in evaluation studies. With the exception of cannabis use which is more prevalent, researchers typically combine all other illicit drug use into a composite 'hard drug use' score, as the prevalence of each of the individual illicit drugs alone is too low [170, 183, 184, 186-189]. This makes it close to impossible to establish the effects of school-based prevention for a specific illicit drug, but allows program providers to demonstrate positive prevention effects overall [183, 184, 187-189]. Alternatively, to overcome this concern, researchers may examine 'intention to use'. Once again, however, reported intentions to use are often low, making it difficult to yield outcomes [26, 159].

Of the few studies which did use harm-minimisation outcomes, the results for these outcomes were mixed. A number of studies demonstrated that school-based drug prevention can successfully reduce the frequency of cannabis [158, 170, 190] and other illicit drug use [183, 184], decrease a composite measure of quantity and frequency of illicit drug use [185] and decrease poly-drug use [159]. One study successfully managed to decrease frequency of a single type of illicit drug use, namely, inhalant use [159]. By contrast, other studies have found no effect on the following harm-minimisation outcomes: frequency of cannabis use [159, 160, 191] [183] [184], use / frequency composite for cannabis and inhalant use [192] and a quantity / frequency composite for cannabis use [193].

Hence, in contrast to alcohol, the capacity to use a harm-minimisation approach and outcomes for studies on the prevention of illicit drugs is less clear. This area warrants further research. One recent study, however, which demonstrates the importance of using a harm-minimisation approach, is that of Swift et al. [194]. In this study, they found that if weekly or occasional cannabis users decided to completely abstain from cannabis use, they were at lower risk than occasional and weekly cannabis of developing cannabis use problems later in life. Persistent weekly users were at the highest risk, with occasional users having a more moderate level of use. This research demonstrates the importance of abstinence as a goal, but also reinforces that even smaller reductions in cannabis use can decrease the overall risk in the longer term. Clearly, this area warrants further research

A further concern that also remains is the capacity to effectively implement the majority of such programs efficaciously, both in research trials and in a real world setting [32]. This is a concern which plagues school-based programs and needs to be addressed in order to improve the efficacy of educational approaches. The next section will review the evidence on the implementation of drug prevention programs in schools.

Obstacles to the effective implementation and dissemination

It is well recognised that the efficacy of school-based drug prevention programs is compromised by implementation and dissemination failure [9, 195-197]. Implementation refers to the degree to which a prevention program is delivered as intended [32, 198]. The degree to which a program is delivered as intended may also be referred to as fidelity, integrity, quality or adherence [9, 32, 197]. Implementation fidelity can be measured in five ways: (1) adherence to the program, (2) the amount of the program delivered, (3) quality of the delivery, (4) participant responsiveness, and (5) program differentiation. Program differentiation examines the extent to which the experimental group receives an intervention which can be differentiated from the control group program [9, 32, 198]. The examination of fidelity is essential in order to determine the extent to which the possible efficacy of a program may be compromised [9, 32, 97]. Although very few studies have examined the relationship between implementation and outcome, not surprisingly, there is a strong relationship between the quality of implementation and the strength of program outcome [9, 32, 197, 199, 200].

In a school-based substance abuse prevention trial for Year 8 students, where Botvin et al. [43] monitored teacher implementation, the intervention was found to be implemented with a low degree of fidelity by many teachers. The overall results suggested that the teacher-led intervention was not effective. However, when only the outcomes of students who had received high quality implementation were examined, the teacher-led intervention was significantly more effective than the control condition for the prevention of tobacco, alcohol and cannabis use. In a further study by Botvin et al. [158], which evaluated the 'Life Skills Training' program over a three-year period, a significant relationship was also found between implementation fidelity and changes in tobacco, alcohol and cannabis use. These studies clearly demonstrate that implementation failure can compromise the efficacy of school-based prevention programs. The extent to which this has occurred in the greater substance abuse prevention research is unclear. Substance abuse prevention studies may be more likely to include a measure of implementation fidelity than research in other areas of psychosocial prevention, but still there remains a paucity of measures of implementation in the literature [9, 32]. There is currently no incentive to include a measure of fidelity as it is not required for publication and to provide an uncalled for, poor measure of fidelity may compromise the possibility of publishing. This, however, makes it impossible to determine whether small or non-significant effect sizes are a result of poorly conceptualised programs or the inadequate delivery of the program [32]. The research on implementation fidelity that does exist in the substance prevention area highlights that poor implementation is a significant concern.

Meta-analyses of school-based drug prevention programs have revealed that effective programs have their content based on a social influence approach and are delivered in an interactive manner [19]. In a review of US schools, although almost two-thirds of teachers reported implementing effective content, only 17% provided an interactive delivery style. Of great concern, was that only 14% used both effective content and effective delivery [201]. The authors of this review concluded that the current practices would do little to prevent or reduce drug use in the United States. This is of considerable concern, given that in the United States, under the Safe and Drug Free Schools program, public schools actually receive funding dependent on using evidence-based drug prevention programs [202], funding which is not offered in many other countries. Such funding, however, may encourage the use of effective programs, but does not guarantee that they are delivered with high fidelity. In a national survey, of a representative sample of lead substance use prevention teachers, it was found that only 15% reported following curriculum guidelines closely [30]. Approximately 80% reported adapting the curriculum to local population needs [203]. These findings are consistent with a further study conducted in the United States which found that only 19% of districts reported implementing prevention programs with high fidelity [204]. Individual studies where measures of fidelity have been collected also highlight this concern. In a study by Botvin et al. [158], it was found that the amount of program content covered in the classroom ranged from 27-97% between the different teachers, with a mean delivery of 68% of the overall material. In another study it was found that a mean of 48% of program points was covered across participating teachers [112]. Since both the content and the delivery style are of crucial importance to the efficacy of substance use prevention, it is imperative to gain an understanding of the factors that impede high fidelity implementation.

A number of factors have been identified which facilitate or impede the effective implementation of substance use prevention programs. Such barriers include teacher training, program characteristics, teacher characteristics, student characteristics, and organisational characteristics [9, 32].

Teacher training

There is a widespread acceptance that teacher training is essential for ensuring that programs are delivered with high levels of fidelity [9, 30, 32, 36, 97, 199, 205]. To increase implementation fidelity, the training needs to have been received recently and be perceived by the recipient to have been of good quality and have led them to feeling well prepared [30]. In a review of current practice in teaching substance use prevention, it was found that teachers with more recent training were significantly more likely to implement effective content and delivery [201]. Teachers who receive inadequate training are likely to implement with lower fidelity [206]

Despite the widespread agreement that teacher training is essential, in a study conducted by Ennett et al. [201], it was found that only 45% of teachers reported receiving recent training. This figure is substantially greater than the mere 18% of teachers who report receiving program-specific training in another review by Wenter et al. [82]. The low proportion of teachers receiving training is most likely because schools are unwilling, or unable, to provide training because it requires the commitment of teacher time and of valuable school resources [201]. Likewise, many programs in schools are simply passed from year to year between teachers with no further training [207].

The inability to provide the time for teachers to receive training is particularly problematic if the current requirements of research-based programs are considered. The majority of these programs rely on extensive teacher/peer training involving a minimum of one-day absence from the usual teaching routine [92, 112, 120, 134, 153, 159, 166, 168-170] and, in the case of the SHAHRP program, teachers were actually required to participate in two days of training [110]. To receive certification to use the program 'Here's Looking at You', teachers were required to attend three days intensive training and an annual one-day booster training session to remain validated. In one study teachers were actually paid to attend training [92]. The capacity for schools to release teachers for a full day of training is resource intensive and difficult in an environment with scarce resources [201].

An alternative which has been trialled is the use of externally trained staff, which in some studies have run or assisted in running of programs in schools [115, 120, 153, 171]. This approach is also problematic in the school environment in terms of co-ordination and cost [9].

In contrast to this view, two empirical studies shed a different light on the importance of teacher training [31, 158, 197]. In these studies it was found that intensive teacher training was no more effective for increasing program integrity than brief training [197] or video training [31]. One author, however, suggests that the inability to find an effect of training may be due to the intensive training not being sufficiently different to the other group who received brief training [197]. These findings, however, may also suggest that extensive teacher training may not be as essential as is currently thought. These findings warrant further investigation given the difficulty inherent in providing teachers with training in the school environment.

Program characteristics

More complex interventions which require special skills and the co-ordination of many people are less likely to be adopted or implemented on an ongoing basis [9]. Likewise, if it is unclear how the drug prevention program fits with other instructional topics, implementation rates are also low, which stresses the importance of creating curriculum-based programs [9, 30, 198]. Teaching constraints also require that teachers are able to measure knowledge change and grade achievement; prevention programs are often skills-based and not set up to meet this requirement, which makes it difficult for teachers to implement programs exactly as intended [207]. Program length, preparation time, accessibility of resources can also determine whether teachers choose to implement part, or the entire program [200]. This is of considerable concern given the nature of research-based programs.

The majority of research based programs are intensive and involve a substantial number of sessions. The Life Skills Training program implemented in a number of the above studies ranges in length from anywhere between 15 to 30 sessions spaced across three years [43, 112, 158, 166, 168, 170, 171]. The SHAHRP program consists of a minimum of 15 sessions spaced over two years [110]. The majority of teachers who participated in this program confirmed that time limitations were the main reason that full implementation of the program was not achieved [208]. To maintain teachers' motivation to implement the SHAHRP program, teachers were provided with constant feedback and encouragement; something that could clearly not occur in the absence of a research team [208]. Other prevention programs, such as some versions of the AMPS program, are almost as intensive [155]. Evaluation of the Skills for Adolescence program actually incorporated 40 sessions and was a condensed version of a 103 session program [165].

In many of these research evaluations the rate and quality of implementation was tightly monitored [31, 43, 85, 110, 112, 134, 150, 155, 158, 161, 162]. Despite this monitoring, which would have had the effect of increasing compliance, many programs were poorly, or not completely, implemented [31, 110, 112, 158, 209]. Under real-world conditions, in the complete absence of monitoring of program implementation, it would be fair to assume that even less of the program would be implemented [32]. The evidence regarding school-based drug prevention programs does suggest that more intensive programs are more effective [7, 19]. However, with the competing demands on limited educational hours, where the predominant focus is on core academic subjects, it is also the longer, more intensive programs that will undergo adaptation or will fail to be implemented at all [200]. This is a considerable issue, since most programs do not clearly specify which program components are essential and which are non-essential [32, 207].

One of the biggest factors that undermine implementation fidelity is the adaptation of programs by teachers to meet the needs of local populations [200, 210]. Adaptation is widespread [200]. In a review conducted in the United States, it was found that nearly 80% of a representative sample of teachers reported adapting the prevention program for local needs. Such needs included the needs of minority youth, students with low English proficiency, students with special needs, behavioural problems and other high-risk behaviours [200]. Teachers may also adapt programs because of a personal preference in teaching style. For example, some teachers prefer not to teach with an interactive style, but like to use different tactics or teaching methodologies to increase student engagement [207]. The teachers who are most likely to adapt programs are those teachers who like teaching substance use prevention and believe that they are doing a good job [203] and that it is their decision rather than having a school administrative body determine which components to implement [30]. Research has also shown that if newly trained teachers adapt programs and fail to adhere to program instruction, it is far more likely to lead to poor outcomes than if experienced teachers do not adhere closely to the guidelines [30, 211].

Conversely, programs that are packaged simply, have clear instructions and are easy to administer are more likely to be implemented and implemented with greater fidelity [9, 32, 196, 199, 205]. Detailed instruction manuals and clear instructions on how the program fits within the broader curriculum have been shown to enhance fidelity [9, 30, 32]. Fidelity may also be enhanced if manuals can clearly specify the essential and non-essential components [32]. Otherwise, there is the risk that essential components can be deleted which will undermine the effectiveness of the program, or untested material may be added, which can also compromise the efficacy [206, 212]. Lack of core program components is the greatest problem [207].

Teacher characteristics

Program integrity has been found to be greater with teachers who are more familiar and effective in the use of interactive teaching techniques (e.g. role-plays, Socratic methods and small group activities), and who felt they could implement the program effectively, and who were enthusiastic about the prevention program [30, 197, 201]. Teacher confidence and belief in the efficacy of a prevention program can also enhance implementation fidelity [30].

A greater number of years of teaching experience has been associated with poorer program integrity [9, 197, 201, 213]. This may be a result of teachers who do have greater experience being less familiar with interactive teaching techniques as they received their training when more traditional didactic teaching methods were being taught. Some teachers are also less comfortable using interactive teaching techniques and are less likely to implement programs effectively [214]. Specifically, in one study, English teachers delivered a prevention program with higher fidelity than social science teachers as they were more familiar with interactive teaching techniques [92]. Many teachers are also unaware of what is meant by 'interactive teaching techniques' and even though they report using such methods in their teaching, trained observers report otherwise. This discrepancy in understanding poses an even greater barrier to effective implementation [215].

Teachers with authoritarian teaching styles have also been found to implement programs less effectively [9]. Low teacher morale and burn-out have also been factors implicated in poor program implementation [206]. In a meta-analysis which investigated the implementation of effective content and delivery, male teachers were also found to use less effective content and delivery than female teachers [201]. This gender difference, however, has not been found consistently across studies [30].

Organisational characteristics

Organisational barriers to effective implementation include lack of time, money and other resources [9, 30, 203, 206]. The many competing demands on teacher time prevent teachers from attending training [197, 201]. Drug prevention programs are also being delivered in a school environment with an increasing emphasis on basic academic areas [87, 206]. Such programs have to compete with many educational demands and, unless they are deemed important, they may only be partially implemented or not implemented at all [32]. Other factors that impede high quality implementation include poor classroom discipline [206, 208, 216], classroom overcrowding [206], and inconsistent staffing [207]. Insufficient program material resulting in schools having to share material between them has also been identified as a factor preventing programs from being completely and effectively implemented [217]. Schools may also deliver evidence-based programs on a large scale which decreases program efficacy by decreasing interactivity [19]. Interestingly, one of the greatest threats to fidelity has been found to occur when teachers believe that it is their choice which components to administer, rather than the principal or other authority [30].

Strong principal and district support, good active administrative support, integration of the program into the curriculum and normal school activities, and 'goodness of fit' between the program and local needs have been found to facilitate program implementation [196, 197, 199, 205, 218]. Teacher morale has also been found to effect implementation [196, 197], but this has not been found consistently across studies [30].

Student characteristics

Not surprisingly, a greater perception by teachers that students are interested in substance abuse prevention programs leads to higher program fidelity [30]. Greater student poverty, discipline problems, youth violence, being in a racial minority, and limited language proficiency are factors which have been associated with lower program fidelity [30, 200, 206, 208]. Students who are more actively involved in the program demonstrate significantly better outcomes. High levels of student absenteeism also limit student exposure to prevention programs [32, 88].

Dissemination of school-based drug prevention programs

Poor implementation of evidence-based programs is not the only factor which compromises the efficacy of school-based drug prevention. Despite the US Safe and Drug Free School (SADFS) funding policy, there is also a problem with the dissemination of evidence-based programs. The SADFS policy has led to a number of reviews being available in the United States which identify and list effective school-based programs. When Ringwalt et al. [196] surveyed a representative sample of US schools, they found that only very few schools implement programs on these lists. Specifically, it was found that only one-third of US public schools and one-eighth of private schools used effective substance use prevention curricula. The discrepancy in level of use between public and private schools may be accounted for by the fact that SADFS funding was not available to private schools. Considering the availability of such funding, the low uptake in public schools was of concern. The SADFS funding was also withdrawn in 2006/2007 [219] which will no doubt even further decrease the use of effective substance prevention programs in the future. Of even greater concern, however, is the finding by Ringwalt et al [196] that the DARE program was the most commonly used. This program has consistently been shown to be ineffective. Another study which has noted a similar pattern of concern was conducted by Hallfors and Godette [204] who reviewed the dissemination of evidence-based programs in 104 school districts in 12 US states. They found that only 59% of districts reported using research-based programs.

Prior to the implementation of SADFS, the low uptake of evidence-based programs had been attributed to poor marketing [197]. In a study by Rohrbach et al. [197], it was found that even when schools had implemented evidence-based programs as part of a research trial, and been provided with extensive training in the process, a year later they had stopped using the program and started utilising untested commercially-based programs. They concluded that this was due to a lack of ongoing contact by the research team, pitted against the visibility, availability and effective marketing of commercial programs. These results stressed the importance of ongoing contact, good marketing and attractive packaging for evidence-based programs. Since the implementation of the SADFS policy and the provision of several reviews that list evidence-based programs the poor marketing, visibility and availability of such programs remains. In a review by Ringwalt et al. [196], it was found that only three of 10 programs which had been identified as effective had available websites which were easy to navigate and provided sufficient information on the content and delivery of the program. This is contrasted with a substantial number of untested commercial prevention programs with glossy packaging which were well marketed. Marketing is extremely important because it has been recognised that teachers are more likely to implement programs they believe are effective. The perceived efficacy of prevention programs and a teacher's capacity to choose an appropriate evidence-based program to meet local needs would be enhanced if research on such programs was not only published in peer reviewed journals, but was also readily available in the public arena [30, 34, 87, 101]. The growing number of programs also makes it difficult for teachers to select the most appropriate, further emphasising the importance of clear and readily available information [87]. In addition, a problem specific to Australia is that many of the programs that are disseminated in government schools are evaluated within this system and the results are not available within the public domain.

Summary

These findings strongly suggest the need to improve the implementation and dissemination of evidence-based programs. Research has clearly demonstrated that social influence programs, which are delivered in an interactive manner, can produce positive prevention effects, and that poor implementation of these programs does lead to poor outcomes. For alcohol prevention programs in particular, Tobler et al. [18] found that a well implemented alcohol prevention program can have eight times the effect size of a poorly implemented program. For this reason, it is important not to make solid conclusions that school-based drug prevention programs are minimally effective when the evidence clearly suggests that very few programs have verified integrity. Such premature conclusions, with regard to the efficacy of school-based drug prevention, risk the discontinuation of the primary means by which drug prevention is delivered to adolescents [30, 31]. Rather, the challenge exists to move from efficacy to effectiveness [206] and ensure that implementation fidelity does not compromise the large-scale dissemination of evidence-based prevention approaches. That is, to enable drug prevention programs to be delivered with high fidelity in real world settings.

In summary, the capacity to transcend the gap from efficacy to effectiveness is best achieved by gaining a clear understanding of the factors which impede and facilitate implementation and then developing programs to overcome such obstacles. In short, school-based drug prevention programs are too complex to easily administer. Insufficient information is provided to readily allow teachers to incorporate such programs with other instructional topics. Prevention programs are not designed in such a way as to allow the flexibility teachers require to adapt the programs to local population needs. Lengthy and cumbersome program requirements conflict with high priority, competing educational demands. Teachers require training to implement programs correctly, but in reality few resources are available to provide such training. Finally, evidence-based programs are generally not visible, available or attractively marketed.

A new and innovative model is required to overcome such issues. For a drug prevention program to be successful it needs to be simple, flexible, and easy to use [9, 206]. It should require limited or no teacher training or preparation, fit clearly within the school curriculum, whilst maintaining student interest. The program needs the capacity to be taken to scale without compromising implementation [206] and, as such, requires a clear program manual which specifies essential and non-essential components [200]. A possible solution to this dilemma is to utilise computer technology to deliver evidence-based prevention.

Overcoming the obstacles to effective alcohol prevention programs

Computer technology

The use of computer technology to deliver prevention programs would have a number of advantages over more traditional means of delivering drug prevention programs, namely, both the content and delivery of the program can more easily be controlled through the use of a computer. Computer programs can deliver up-to-date current information and provide complete and consistent delivery, decreasing the demand for teachers to have ongoing training. Inbuilt in computer technology is the capacity for engaging interactivity and dynamic delivery which has been shown to engage students and increase retention [220, 221]. Students enjoy learning by computer more than by traditional methods of teaching and develop more positive attitudes to learning and retain information longer [222, 223]. The use of computer technology in comparison to more traditional teaching techniques has been shown to accelerate learning, potentially enabling programs to be shorter [224, 225]. Computer-assisted learning has also been shown to improve educational outcomes and achievement [224, 225]. Well-designed computer programs guarantee simplicity and ease of use. In addition, computers have the capacity to collect, calculate and store information necessary to establish individual student achievement and his/her ability to meet tightly specified educational outcomes. They also have the capacity to provide automated individual outcome and achievement reports. Once the initial development costs have been met, computer resources provide a cost-effective means for delivering and disseminating drug prevention programs. Importantly they provide the capacity of going to scale without compromising fidelity.

The feasibility of delivering preventive health using computer technology

The feasibility of delivering preventive health information via computer is supported by a growing body of evidence which shows computer programs can successfully deliver health information for a wide range of mental health concerns. In a study by Kenwright et al. [226], computer-aided self-help was provided to adults wishing to receive treatment for phobia/panic. Potential program recipients were alerted to the availability of this computer resource through anxiety groups or by advertisements in general practice settings. All patients were screened for eligibility. Those who were eligible completed six sessions of computer-guided self-help. Each session was approximately 40–50 minutes in length. At the beginning of each session, a nurse spent 10 minutes with the patient to review progress and exposure homework. The progress of these patients was compared with panic/phobia outpatients from a nearby clinic. Results revealed that both the self-care and the outpatients improved comparably, but the computer guided patients spent 86% less time with the clinician/nurse. This study shows that nurse monitored computer intervention is a feasible and acceptable means for treating phobia/panic and has the capacity to allow a nurse to treat a greater number of patients with the time they have available. The main limitation of this study was that the clients who attended the care centre initially had less severe disorders. Further research has demonstrated that the severity of a disorder may not rule out the use of a computer-aided intervention.

Proudfoot et al. [227] evaluated the effectiveness of a cognitive behavioural computer intervention for patients with anxiety, depression or mixed anxiety/depression. Eligible patients were either randomly allocated to receive the computer intervention or treatment as usual. To receive the computer intervention, patients were required to attend their general practice and complete the intervention under minimal supervision. The intervention consisted of nine weekly sessions each of approximately 50 minutes duration, with the exception of the first which was only 15 minutes in duration. In comparison with the control, patients who received the computer intervention had decreased levels of depression and anxiety and demonstrated greater work and social adjustment. This was irrespective of pharmacotherapy or initial patient severity. A limitation in this study was that the patients in the 'treatment as usual' group were not required to attend the practice on a weekly basis. Attending the practice may have provided the patients in the computer intervention with some life routine, which in itself is indicated in the treatment of depression and may have contributed to the positive program outcome.

In a further evaluation of this program, with a large sample of moderately to severely depressed patients in general practice [228], the computer program was found to be more effective than treatment as usual at decreasing depression and anxiety, decreasing negative attributions, improving work and social adjustment, improving positive attributions and increasing satisfaction with treatment. The efficacy of this program was unaffected by age, gender, concomitant pharmacotherapy or duration of pre-existing illness. Satisfaction with treatment was higher in the group receiving the computer intervention than in the treatment as usual condition. The computer-delivered intervention was acceptable and feasible, and in a further study was demonstrated to be a cost-effective treatment for depression [229].

The capacity for computer interventions to be web-based has a further advantage of increasing the availability and accessibility of mental health interventions. In a study by Christensen et al. [230], adults with increased depressive symptoms who were not currently receiving treatment were recruited from the community and randomised into one of three treatment conditions: website for psycho-education, website offering cognitive behaviour therapy (CBT) or a control condition. Participants in all three groups were contacted weekly. Those in the control group discussed lifestyle and environment issues potentially impacting on their depression. Those in the web-based interventions were provided with direction on their use of the websites. Both the information and the CBT delivered via the internet were found to be more effective in decreasing depressive symptomotology than a credible control. The CBT condition was successful in decreasing dysfunctional thinking and increasing knowledge about CBT. The information only website significantly improved participants' understanding of the effective evidence based treatments for depression.

These studies demonstrate the feasibility, acceptability, availability and cost-effectiveness of delivering health information via computer. Many other studies exist demonstrating the capacity for computer intervention to provide feasible and effective interventions without jeopardising health outcomes. Ghosh [231] compared computer therapy for phobias with that delivered by a book or by a clinician and found all three to be equally effective. Newman et al. [232] compared 12 therapist delivered CBT sessions to four computer assisted CBT sessions for the treatment of panic disorder. Both treatment interventions were comparable and produced clinically significant reductions in panic disorder. The advantage of the computer intervention was that it was more cost-effective, whilst remaining equally acceptable to clients. Kirkby et al. [233] utilised a computer game simulation which enabled clients to experience vicarious exposure and practice response prevention for the treatment of Obsessive Compulsive Disorder (OCD). Despite being limited by a small sample size and short follow-up, this study demonstrated that greater exposure and response prevention was associated with greater reductions in pathology.

Clearly, computers provide a viable means of delivering mental health education to adult populations. The important next steps are to demonstrate that it is both feasible and acceptable to deliver health education via computer to children and adolescents, and that it is possible to deliver preventive drug education in particular. A number of studies support the feasibility and acceptability of such a venture.

The feasibility of using computer technology to deliver prevention to adolescents

Computers appeal to young people. Adolescents would prefer to learn drug education via computer technology than by traditional means [148, 224]. Young people are familiar with computers and use them frequently. In Australia, in the 12 months to April 2003, 95% of children aged 5–14 years used a computer during or outside of school hours. Ninety-four percent reported using a computer at school and 86% reported using a computer at home. Most children who used computers did so more than once a week [234]. In 2003, in the United States, 86% of children were living in a household with a computer and approximately 95% of young people between 10-17 years of age reported having used a computer in that year [235]. Over 90% reported using a computer at school and over 80% at home. In the United Kingdom, in a sample of eight to ten year olds, 89% had access to a computer at home [236].

Computer usage is not only attractive to young people, but also has many educational advantages [225]. Computer-aided learning allows students to learn at their own pace. They can gain quick and individualised feedback that is not possible in a traditional classroom setting. A student's learning is enhanced when a computer program allows and demands each child's individual response, which is contrasted to a traditional classroom setting where only one student usually gets to respond. Well-designed computer programs allow varied and stimulating content which has the capacity to hold a young person's interest long enough to learn. Computer learning environments are also complex enough to provide meaning and practical application to learning and allow students to solve problems anchored in simulations of real world situations [225]. Simulations allow the capacity for young people to navigate through, and experience, a life situation which may not otherwise be possible [237]. Computer programs have also been shown to be ideal for delivering information on sensitive topics, because they afford the opportunity for anonymous and confidential disclosure which may not otherwise be possible in a classroom setting [238].

A growing body of literature exists on the implementation of computerised drug prevention programs for youth. Computer-based drug prevention programs for adolescents have been evaluated in hospital emergency departments [239], community agencies [240-242], at home [243] and within school settings [238, 244, 245]. These programs generally involve young people navigating their way through simulated real-life situations involving characters and contexts to which they can relate [239, 241]. The current range of youth drug prevention programs are both brief [239, 244] and intensive [240, 241, 243, 245] and have been designed for both universal [238-241, 243-245] and targeted populations [238, 242].

The majority of evidence available in peer reviewed journals suggests that these programs are both highly feasible and acceptable in the community [240-242], hospital [240], and school settings with youth of all levels of risk. Youth, parents and staff in these locations have positively evaluated the use of such programs [239, 241]. In one community-based trial, the youth enjoyed the computer program to such an extent that community staff had to stop them from moving on to future lessons at each session [242]. The staff in the same centre also wanted to include many more youth in the trial well after it had commenced. In a further study in a school setting, it was found that 60% of students accessed a computer-driven prevention program during their free time at school [238]. Almost all the students who accessed the program chose to use it again. On average each student accessed the program 18 times in a 14-month period and chose to access the section of the program that pertained to his/her area of risk (e.g., smoking, sexual activity, or alcohol and other drug use). This program clearly demonstrates the acceptability of computer technology with young people and demonstrates that high-risk youth find this a suitable option for obtaining information they may normally be too embarrassed or uncomfortable to seek out. Males were also the dominant users of this program, which the authors considered an impressive accomplishment, given that adolescent males are hard to reach with risk information education [238].

Computer-based drug prevention programs have not been found to be as feasible and acceptable for young people in all settings [243]. Specifically, the delivery of home-based interventions may not always be acceptable, and this appears to depend on the circumstances in which they are implemented. In one study [246], a home-based computer prevention program for smoking was found to be highly acceptable to school students. By contrast, in another study evaluating a CD-ROM drug prevention program, only 58% of eligible participants agreed to participate despite attractive remuneration [243]. This difference in acceptability was no doubt related to the recruitment protocol. In the computerised smoking prevention program, all students in the entire school year group were involved in the smoking prevention program during the school term, whereas the low participation rate in the latter study may have resulted from students being approached to take part in a prevention program as an additional non-compulsory activity, separate to the school, during their school holidays [243]. It is most likely, that any program, computer-based or not, would be unattractive to most students under these circumstances.

The use of computer based programs with youth, for the most part, appears to be both feasible and acceptable [238, 239, 241-245]. In terms of efficacy, computer based drug prevention programs have been shown to be effective in changing knowledge [240], attitudes [243] and skills [243, 244], but the evidence for behavioural change is more scant. Specifically, computerised drug prevention programs for youth have been shown to increase knowledge [240], decrease pro-drug attitudes [240, 243, 245], increase drug resistance [244], increase anxiety management skills [243, 245] and decrease reported intention to use drugs [239, 244]. Such programs have also been successful in decreasing young people's normative expectations regarding peer and adult alcohol consumption [243] and increasing the likelihood that young people will respect the rights of other youth to decline the use of drugs [244]. The strength of these findings is greatly limited by very short-term follow-up periods, making it unclear whether such changes are sustainable [239, 244, 245].

The capacity of computer-driven drug prevention programs to demonstrate behavioural change is promising. In a study by Schinke et al. [241], youth who were recruited from a community setting to complete a 10 session CD-ROM drug prevention program were found to have lower monthly rates of alcohol, tobacco and cannabis use than young people who did not receive the intervention. These results were sustained up until three years follow-up. The addition of a relatively intense parent intervention, which included a 30 minute videotape, two hour workshop and a CD-ROM was found to significantly augment reductions in drug use, particularly at the three year follow-up. This study provides strong evidence for the effective use of computer-delivered interventions with young people. It is, however, highly intensive and requires substantial co-ordination. The identified factors decrease the likelihood of the intervention being delivered in the real world [30].

The Body Awareness Resource Network (BARN) research group [238] also found that an interactive computer program delivering information on critical adolescent health issues, including alcohol and other drugs, was effective in reaching high-risk populations and effective in slowing progression from non-use, to experimental use to problem use. Finally, a computerised smoking prevention program for school students was also found to be effective in encouraging cessation in existing smokers and delaying onset in non-smokers [246]. The computer component in this study was different to other studies. In this study, the computer was used to generate personalised feedback letters based on responses to baseline questionnaires. These letters provided strategies and information based on a social influence approach to assist students not to take up or to give up smoking. Students did not actually participate in a computer-driven intervention beyond baseline.

Although these results are promising, the evidence for behavioural change is, at present, limited. The majority of studies which have evaluated the efficacy of computer -based drug prevention programs for youth have failed to collect measures of behavioural change [239, 240, 244, 245]. Two studies evaluating computer-based drug prevention programs have also failed to demonstrate changes in substance use behaviour. In a community-based study, despite high levels of youth acceptance, a computer-based intervention for high-risk youth failed to demonstrate any effects for alcohol or other drug use behaviour [242]. Behavioural change was also not demonstrated in a highly motivated group of school students who agreed to complete a CD-ROM drug prevention program at home during the school holidays [243]. In both studies, the program content was based on programs which had previously been shown to be effective. The lack of demonstrated behavioural change may have resulted from the low prevalence of drug use in the age group and the short-term period of follow-up.

Delivering drug education using a computer based resource is clearly both feasible and acceptable with young people. Preliminary evidence also suggests that delivering drug education using a computer-based resource is feasible in a classroom setting [244, 245]; however to date, such programs have only involved a single session and have not demonstrated behavioural change.

Summary

In summary, evidence exists to suggest that the use of computer technology to deliver school-based alcohol prevention is attractive, feasible and acceptable to adolescents. Computer-delivered drug prevention programs have demonstrated the capacity to increase knowledge, decrease pro-drug attitudes, decrease the intention to use drugs, instil conservative norms and increase resistance and anxiety management skills. The evidence with regard to behavioural change is more scant. Preliminary evidence suggests that it may be possible to deliver drug prevention programs in the classroom. The challenge remains to assess if it is feasible and acceptable to deliver a fully integrated program involving multiple sessions in the school classroom. Importantly, computer programs have the potential to hold young people's attention and let them learn and problem solve in real-life situations which may help to facilitate behavioural change. Computer technology also has the capacity to increase the rate of learning, making way for shorter programs which may be more suitable for implementation in the school environment. Such programs can offer complete, correct and consistent delivery without intensive teacher training. Well-designed computer programs guarantee simplicity and ease of use, and have the capacity to be cost-effective and go to scale without comprising fidelity.

Conclusion

The efficacy of school-based drug prevention has been limited by a focus on abstinence-based outcomes and obstacles to the effective implementation and dissemination of programs. Significant evidence suggests that the use of a harm-minimisation approach in combination with computer-based delivery may aid in increasing the efficacy of school-based drug prevention programs. Hence, the first aim of the current research was to develop and evaluate a computer-based harm-minimisation program for the prevention of alcohol misuse in secondary schools students. The development and evaluation of this module will be briefly described in Chapter 4.

CHAPTER 4: CLIMATE SCHOOLS: ALCOHOL MODULE[4]

CLIMATE Schools: Alcohol Module is a universal school-based alcohol prevention program which was developed in response to the urgent need to address the alcohol-related morbidity and mortality experienced by young people. This was detailed in Chapter 2. Although there are a bourgeoning number of school-based alcohol prevention programs, it is clear from the literature reviewed in Chapter 3 that the efficacy of such programs has been impeded by two factors: implementation failure and a focus on abstinence-based outcomes. In an attempt to overcome such concerns, CLIMATE Schools: Alcohol Module was developed based on a harm-minimisation approach and designed to be delivered utilising computer technology.

The development of CLIMATE Schools: Alcohol Module

CLIMATE Schools: Alcohol Module is based on best-practice research and the principles that underpin effective drug prevention in schools [14, 16, 33, 39, 247]. It was developed in collaboration with teachers, students and relevant health and legal professionals to ensure that all relevant issues from the different perspectives could be addressed. This process involved extensive focus-group testing and individual interviews, which allowed for a more thorough understanding of the obstacles facing prevention efforts, and provided a venue to brainstorm possible solutions. This process has been recommended in previous research as

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[4] Sources for Chapter 4:

Chapter 4 is a brief summary of the development and evaluation of CLIMATE Schools: Alcohol Module. The full details of this work can be found in the following documents.

Vogl, L. E. (2007). CLIMATE Schools: Alcohol Module - The feasibility and efficacy of a universal school-based computerised prevention program for alcohol misuse and related harms. Unpublished PhD, University of New South Wales, Sydney.

Vogl, L., Teesson, M., Andrews, G., Bird, K., Steadman, B and Dillon, P (2009) A computerised harm-minimisation prevention program for alcohol misuse and related harms: randomised controlled trial. *Addiction*, 104(4), 564-575

Newton, N.C., Vogl, L.E., Teesson, M. and Andrews, G. (2009). CLIMATE Schools: Alcohol Module: Cross-validation of a school-based prevention programme for alcohol misuse. *Australian and New Zealand Journal of Psychiatry*, 43(3), 201 — 207

Vogl, L. and Teesson, M (2006). The efficacy of a computerised school based prevention program for problems with alcohol use: CLIMATE Schools. *Alcoholism: Clinical and Experimental Research, Suppl.,* 30(6), 198A.

an effective means of overcoming identified obstacles to the effective implementation of prevention programs [9, 195, 212]. The final curriculum-based program consists of six lessons, each with two components. The first component involves students completing an interactive computer-based program, with the second consisting of a variety of individual, small group and classroom-based activities [35].

More specifically, the computer component involves students navigating their way through a cartoon-based teenage drama. Each lesson deliberately forms part of an ongoing teenage story to encourage teachers to present all lessons and avoid the temptation to omit any of the planned lessons. The computer delivery guarantees that the complete content is consistently delivered to each student, thereby overcoming the majority of the identified obstacles to effective program implementation. Classroom activities are included to allow students to interact with the content in relation to their own lives. These activities include role plays, small group discussions, decision making and problem solving activities and skill rehearsal, all of which have been identified as being central to program efficacy [13-19]. The intervention is delivered by computer and the classroom teacher.

The evaluation of CLIMATE Schools: Alcohol Module

The feasibility and efficacy of CLIMATE Schools: Alcohol Module [35] has been assessed utilising a cluster RCT involving 1466 Year 8 students (13 years old) from 16 schools in NSW and ACT [11]. CLIMATE Schools: Alcohol Module was found to be both feasible and acceptable in the school setting. The provision of alcohol prevention information in the background of a computerised teenage drama provided young people with an education program they enjoyed in a context to which they could relate. Teachers reported a willingness to implement CLIMATE Schools: Alcohol Module in routine practice, believing it to be a high quality program which was superior to other drug education programs.

In comparison to alcohol prevention education currently delivered in schools, 'CLIMATE Schools: Alcohol Module' led to significantly greater increases in knowledge of harm-minimisation skills and subdued alcohol-related expectancies. It was more effective than usual alcohol prevention education in reducing alcohol use, misuse and related harms for females. It has proved to be equally effective as usual alcohol prevention education for males. Reducing problems among males remains a challenge, which will need to be embarked upon in further 'CLIMATE Schools Modules'.

The efficacy of the CLIMATE Schools: Alcohol Module has also been examined in a cross-validation trial utilising a different cohort of schools than previously studied. The importance of cross-validation and in prevention research continues to be raised in the literature as a necessary step to thoroughly evaluate the feasibility and efficacy of school-based prevention programs, as without it, we cannot know if a program can be generalised to new settings or make an impact on a larger scale [248, 249]. The cross-validation trial of the CLIMATE Schools: Alcohol Module comprised 764 Year 8 students (13 years old) from ten schools in

NSW [20]. Results from the trial demonstrated the CLIMATE Schools: Alcohol Module to be effective in increasing alcohol related knowledge up to six month following the intervention, and reducing average consumption of alcohol immediately after the intervention. Overall, this study attests to the generalisablilty of the CLIMATE Schools: Alcohol Module as an effective harm-minimisation prevention program to reduce alcohol misuse in adolescents. This research has clearly shown that 'CLIMATE Schools: Alcohol Module' is both feasible and acceptable, and has the potential to offer a practical and innovative new platform for the delivery of drug prevention programs in schools.

Applying the CLIMATE Schools model to illicit drug use

Based on the strength of the results from the CLIMATE Schools: Alcohol Module, the next step was to assess if this innovative new platform of delivery for school-based drug prevention could be extended to other drugs of concern in adolescence. Given that cannabis and psychostimulants are two of the three most commonly used illicit drugs among Australian youth [21], these were importantly the next drugs on which to focus. As discussed in chapter 1, due to the differing average age of initiation of cannabis and psychostimulant use, as well as the need for sequential and developmentally appropriate programs, the decision was made to create two further modules:

- CLIMATE Schools: Alcohol and Cannabis Module
- CLIMATE Schools: Psychostimulant and Cannabis Module

Possibly one of the greatest challenges in extending this platform to illicit drug use is the acceptability of using a harm-minimisation framework for illicit drugs in schools. Despite the fact that a harm-minimisation approach is in line with a Australia's National Drug Strategy [250], illicit drug use in Australia is less common than alcohol use, with approximately one in 10 Australians having used any illicit drug in the past year and the majority of Australians viewing illicit (rather than licit) drugs to be associated with a 'drug problem' [149]. Given the lower prevalence of use and the greater concern regarding such drugs, it may well be the case that some people feel that using a harm-minimisation approach with young people is condoning the use of drugs, which has long been the view expressed by the proponents of the abstinence-based approach [125].

Despite these concerns, research conducted by Midford [27] on attitudes to using a harm-minimisation approach in school drug education are encouraging. According to this research, teachers do not appear to be concerned by the use of a harm-minimisation approach to illicit drug use, and would actually welcome such an approach. Teachers stated that a harm-minimisation approach would allow for a more meaningful dialogue with students which was not hypocritical and did not impose a moral position. Students in this study also reported a preference for a harm-minimisation approach as they believed that it was more realistic and would allow them to be more honest about drug use without feeling judged. Greater concern about harm-minimisation principles, on the other hand, was expressed by administrators and parents in this study. For parents, however, concerns could be allayed by explanation, information and exploration of their concerns. The challenge was for administrators in making a harm-minimisation approach consistent with their discipline policies. For this reason, extensive guidelines have been provided to schools to address this dilemma [14, 17, 247].

In terms of effectiveness, the prevention of illicit substance use should be less of a challenge than that of alcohol. Specifically, successful prevention does require some level of societal disapproval, otherwise young people may view the message to be hypocritical [139, 150]. Given the prevalence of illicit drug use in comparison to the more widespread and ubiquitous use of alcohol in Australian society, illicit prevention messages should therefore be perceived as more credible.

Hence, the aim of the current research is to develop and evaluate computer-delivered school-based prevention programs based on a harm-minimisation approach for cannabis and psychostimulant use. The development of these programs used the same methodology as the CLIMATE Schools: Alcohol Module and for this reason will not be repeated. The aim of the current research is to assess whether these programs are:

- Both a feasible and acceptable means of overcoming the obstacles encountered in the implementation of school-based illicit drug prevention; and
- Effective in decreasing cannabis, psychostimulant use and related harms.

Chapter 5 will outline the evaluation of the CLIMATE Schools: Alcohol and Cannabis Module and Chapter 6 will outline the evaluation of the CLIMATE Schools: Cannabis and Psychostimulant Module.

Chapter 5: The efficacy of CLIMATE Schools: Alcohol and Cannabis Module[5]

Introduction

This chapter will describe the RCT used to evaluate the feasibility and effectiveness of CLIMATE Schools: Alcohol and Cannabis Module. The CLIMATE Schools: Alcohol and Cannabis Module is a universal school-based prevention program which has been developed in response to the need for the prevention of alcohol and cannabis use, the two most commonly used licit and illicit drugs in most developing countries [251]. As outlined, the burden of disease associated with these drugs is considerable [252], with alcohol coming second only to tobacco as the cause of drug-related mortality, morbidity and economic costs [46]. The need for prevention in the area of alcohol and cannabis use is clear.

As outlined in Chapter 3, although an array of school-based drug and alcohol prevention programs exist, the outcome of many of these is compromised by implementation failure and a reliance on abstinence-based outcomes [253]. CLIMATE Schools: Alcohol and Cannabis Module is based on a social influence approach to prevention [13], adopts a harm-minimisation approach and is delivered over the internet, thereby guaranteeing consistent and easy delivery [225]. The aim of the current chapter is to assess whether the integrated Climate Schools: Alcohol and Cannabis Course is: (1) effective in reducing alcohol and cannabis use, and (2) is acceptable to both students and teachers as a program which overcomes the common obstacles in school-based drug prevention.

Method

Design of the RCT

To demonstrate the efficacy of the Climate Schools: Alcohol and Cannabis Course, a cluster RCT was implemented. Schools were randomly assigned to either the intervention condition

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[5] Sources for Chapter 5:

Chapter 5 covers the development and evaluation of CLIMATE Schools: Alcohol and Cannabis Module. The full details of this work can be found in the following documents:

> Newton, N.C. (2009). The development and evaluation of a school-based prevention program for alcohol and cannabis use delivered via the internet. Unpublished PhD, University of New South Wales, Sydney.
>
> Newton, N.C., Andrews, G., Teesson, M. and Vogl, L.E (2009). Delivering prevention for alcohol and cannabis using the internet: A cluster randomised controlled trial. *Preventive Medicine*, 48, 579-584.

where students received the combined Climate Schools: Alcohol and Cannabis Course over Year 8, or to the control condition where students received their usual Personal Development Health and Physical Education (PDHPE) classes over the year. Self-reported questionnaire data was collected from all students on three separate occasions: both before and after the Climate Schools: Alcohol and Cannabis Course, and again after six months to look for lasting effects. Students from the control schools completed the same pattern of assessments as shown in Table 2 below. To ensure anonymity, student responses were linked overtime using a unique identification code adapted from SHAHRP [208, 254].

Table 2: Control and Intervention group assessment times

	Pre-intervention (survey 1)	**Climate Schools: Alcohol Module**	**Climate Schools: Alcohol & Cannabis Module**	**Post-intervention (survey 4)**	**Six month follow-up (survey 5)**
Timing	Term 1, Year 8 (2007)	Term 1, Year 8 (2007)	Term 3, Year 8 (2007)	Term 3, Year 8 (2007)	Term 1, Year 9 (2008)
CONTROL	X			X	X
INTERVENTION	X	X	X	X	X

Climate Schools intervention

The Climate Schools: Alcohol and Cannabis Course comprised the delivery of two Climate Schools modules aimed at decreasing alcohol and cannabis use and related harms. The Climate Schools: Alcohol Module was delivered immediately after baseline assessment and the Climate Schools: Alcohol and Cannabis Module (which included some repeat of the alcohol material) was delivered six months later. The two modules were each comprised of six 40-minute lessons. Each lesson included two sections: the first being a 15 to 20-minute internet-based program completed individually where students followed a cartoon storyline of teenagers experiencing real-life situations and problems with alcohol and cannabis. The second part of each lesson was a predetermined activity delivered by the teacher to reinforce the information learnt in the cartoons. The activities, along with lesson summaries and links to the syllabus, were included in the Teacher's Manual which teachers were provided with prior to the intervention.

The Teacher's Manual for the Climate Schools modules, and the computer-based material for both modules is available online at www.climateschools.com.au.

Control schools drug education

The control schools in the study received their usual PDHPE classes over the year. All schools except one received syllabus-based alcohol and cannabis drug education during the year. The programs used by schools were also social influence programs based on harm-minimisation strategies. The number of lessons which focused specifically on alcohol and cannabis in Year 8 varied substantially between the schools (between five and 22 lessons) and two of the schools noted that the main content of syllabus-based drug education is taught in Year 7 at their schools and that in Year 8 they only loosely covered drug education. No schools reported delivering these programs via computers or the internet.

Participants

Ten schools agreed for their Year 8 classes to participate in the research. Information and consent forms were sent home to parents/guardians of the Year 8 students, and only those who consented were involved in the study. Consent was obtained from 944 students; however, only 764 students were present at the baseline assessment. At baseline the mean age of participants was 13.08 years (SD=0.58) and 60% were male. Five schools (n=397) were randomly allocated to the intervention (Climate Schools) condition and five schools (n=367) to the control condition.

Measures

A self-report online questionnaire was completed by all students in a classroom setting where anonymity and confidentiality were assured. Demographic data was obtained and the questionnaire measured alcohol- and cannabis-related knowledge, alcohol consumption (frequency, quantity and bingeing), cannabis use (ever tried and frequency of use), positive expectancies about alcohol and cannabis, and harms associated with alcohol and cannabis use.

Demographics. Socio-demographic information including students' gender, age, average school grades and rates of truancy were obtained to determine the equivalence of the two conditions.

Alcohol-related measures

Alcohol knowledge. The knowledge questionnaire was adapted from the SHAHRP 'Knowledge of Alcohol' index and included 16 items assessing students' knowledge of alcohol. Students were asked to indicate 'true', 'false', or 'don't know' to each statement. A higher score on this scale represents higher alcohol-related knowledge. The SHAHRP knowledge of alcohol index has good reliability (alpha=0.73) [208].

Alcohol consumption. The alcohol consumption questionnaire was adapted from the SHAHRP 'Patterns of Alcohol' survey instrument and included three items measuring: (1) frequency of consumption over the past three months, (2) quantity of consumption in standard drinks over the past three months, and (3) frequency of consuming above low-risk levels for occasional consumption in the past three months (over four standard drinks for females, and over six standard drinks for males on one occasion) as defined by the National Health and Medical Research Council from 2001 [255]. (Nb. Updated guidelines were published in March 2009 [256]; however, these guidelines were not available at the time this data was analysed and hence were not used in the present study.) An overall index of 'average weekly alcohol consumption' over the past three months was created by multiplying items 1 and 2. The SHAHRP alcohol consumption index had good test-retest reliability over time (r=0.84) [208].

Alcohol-related harms. Alcohol harms were measured using the SHAHRP survey instrument reflecting harms experienced from students' own use of alcohol. Five items were eliminated from the scale due to low variance in both the SHAHRP study [208] and the initial testing of the Climate Schools: Alcohol Module [257], leaving 12 items in total. Respondents had to indicate on a six-point scale how many times they had experienced each harm in the past 12 months (0, 1, 2, 3-4, 5-11, 12+). The types of harms varied in nature and included 'how many times were you sick after drinking?', 'how many times did you get into a physical fight with someone because you were affected by alcohol?' and 'how many times did you get into trouble with your parents because of drinking?'. The SHAHRP alcohol-related harm index had good internal consistency (alpha=0.90) and test-retest reliability (r=0.89) [208].

Alcohol-related expectancies. Expectancies in relation to consumption of alcohol were measured using the Alcohol Expectancy Questionnaire – Adolescent (AEQ-A) form [258]. Due to time constraints, this study used only one of the seven scales within the AEQ-A, termed 'alcohol can enhance or impede social behaviour'. This scale was chosen on the basis that Christiansen et al. [259] found this scale to have the highest concurrent, predictive and discriminant validity for alcohol consumption and related problems, and accounted for the majority of predictive variance at a one-year follow up. It was also chosen because research has found alcohol consumption to be best predicted by scales that measure alcohol's expected effects on social behaviour [259-262]. Items in the scale included statements such as 'drinking alcohol makes people more friendly', and 'drinking alcohol creates problems'. Students had to respond with either 'true' or 'false' to each item.

Cannabis-related measures

Cannabis knowledge. The cannabis questionnaire was adapted from the 'cannabis quiz' and included 16 items assessing students' cannabis knowledge [263]. Students indicated if each statement was 'true', 'false', or, 'don't know'. A higher score represented higher cannabis-related knowledge.

Cannabis use. Cannabis use was assessed using a questionnaire based on the 2007 NDSHS assessing the frequency of cannabis use in the past three months [21].

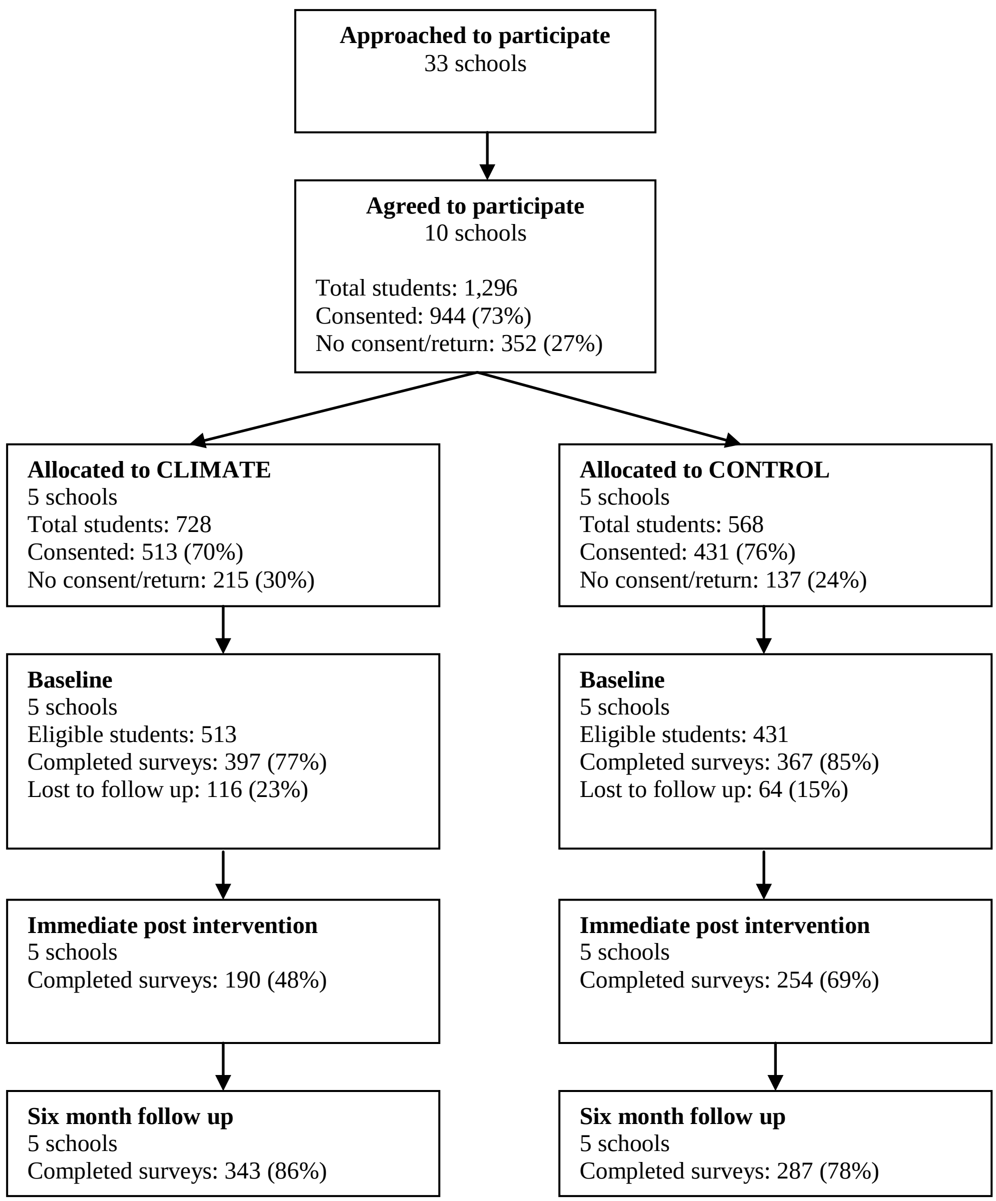
Cannabis harms. Cannabis harms were assessed with six questions derived from the SHARHP instrument for alcohol harms [208] and from the Adolescent Cannabis Problems Questionnaire (test-retest reliability, r=0.91)[264]. Respondents had to indicate if they had or had not experienced that harm in the past 12 months.

Cannabis attitudes. Positive attitudes towards cannabis were measured by four items derived from the LST Questionnaire [265]. Each item was a statement regarding cannabis such as 'smoking cannabis makes you look cool', and 'adolescents who use cannabis have more friends'. Respondents had to indicate on a five-point scale how much they either agreed or disagreed with each statement.

Results

Seven hundred and sixty-four students completed baseline questionnaires, 444 students provided data immediately after the course (after the intervention schools had completed both the Climate Schools modules), and 630 students provided data six months following the intervention. Figure 1 represents the number and percentage of students in groups over time.

Figure 1: Flow chart of recruitment and participation of schools



Baseline equivalence

Baseline equivalence and attrition between groups were examined using a series of one-way Analysis of Variance tests (ANOVA) for normally distributed data, Chi-square test for binominal data, and Mann-Whitney U tests for non-normally distributed data. At baseline there was a significant difference in the proportion of males and females in the CLIMATE and CONTROL groups (χ^2 (1) = 8.729, $p < .05$), with significantly more males in the CONTROL (65% male) versus CLIMATE (54% male) group. At baseline, students in the CLIMATE group (M=1.42, SD=1.03) had significantly higher rates of truancy than students in the CONTROL group (M=1.24, SD=0.76) (F (1, 760) = 27.52, $p < .01$), but no differences in academic grades were observed between groups (F (1, 759) = .93, $p = .34$).

At baseline, the students in the CLIMATE group had significantly higher alcohol-related knowledge (F (1, 758) = 6.17, $p < 0.05$), higher cannabis-related knowledge (Mann Whitney U, $z = -2.52$, $p < .05$), higher average weekly consumption of alcohol (Mann Whitney U, $z = -2.35$, $p < .05$), and higher frequency of bingeing in the past three months (Mann Whitney U, $z = -3.68$, $p < .01$), than students in the CONTROL group. There was no significant difference between groups in the number of harms experienced as a result of their own alcohol use (Mann Whitney U, $z = -1.53$, $p = .13$), the proportion of students ever trying cannabis (χ^2 (1) = 2.41, $p = 0.30$), the number of harms experienced as a result of their own cannabis use (Mann Whitney U, $z = -1.19$, $p = .23$), their attitudes towards cannabis (Mann Whitney U, $z = -.214$, $p = .83$), or frequency of cannabis use over the past three months (Mann Whitney U, $z = -.95$, $p = 0.34$). For both groups, alcohol and cannabis use at baseline was comparable to larger population-based studies [21].

Attrition and differential attrition

Attrition analyses were conducted to assess comparability of students who were present at baseline only (SINGLE) versus students who were present at baseline and at least one follow-up occasion (REPEAT). Attrition resulted from students being absent on the day of the surveying, failing to use their unique identifying code, or answering less than 80% of the items on any scale.

Compared with those students who were retained after baseline, analyses revealed that students lost to any follow-up occasions had significantly higher levels of binge drinking in the three months prior to the baseline survey (1.42 versus 0.55 episodes; Mann Whitney U, $z = -2.65$, $p < .05$). There were no significant differences between SINGLE and REPEAT cases on any other alcohol or cannabis outcome measures.

There was no evidence of differential attrition on the alcohol or cannabis outcome measure for the CLIMATE and CONTROL conditions. That is, there was no significant difference between the rates of attrition in the intervention group compared to the control group. Table 3 provides the mean scores and standard deviations for the CLIMATE and CONTROL groups for all alcohol and cannabis outcome measures for each survey occasion respectively.

Table 3: Means (and standard deviations) for student alcohol and cannabis outcome data over the three survey occasions

Outcome measures	Group	Baseline	Post	Six month follow up
Alcohol knowledge	CLIMATE	7.75 (2.91)	9.90 (3.55)	10.03 (2.80)
	CONTROL	7.26 (2.53)	7.74 (2.93)	7.98 (3.01)
Average weekly alcohol consumption	CLIMATE	3.55 (15.69)	3.50 (15.83)	1.53 (5.50)
	CONTROL	0.84 (5.39)	1.30 (7.37)	3.42 (14.76)
Frequency drinking to excess on a single occasion	CLIMATE	0.62 (2.96)	0.39 (2.38)	0.68 (2.21)
	CONTROL	0.23 (1.90)	0.26 (1.26)	0.36 (1.32)
Alcohol harms	CLIMATE	6.86 (26.72)	8.28 (29.17)	4.93 (13.40)
	CONTROL	2.87 (12.15)	3.24 (11.25)	5.79 (16.19)
Positive alcohol-related expectancies	CLIMATE	5.87 (3.90)	5.35 (3.70)	6.70 (4.08)
	CONTROL	5.90 (3.73)	6.69 (3.80)	7.31 (4.00)
Cannabis knowledge	CLIMATE	9.52 (3.37)	12.11 (3.84)	11.28 (3.33)
	CONTROL	9.08 (3.05)	9.59 (3.78)	9.52 (3.52)
Frequency of cannabis use	CLIMATE	0.13 (0.92)	0.18 (1.07)	0.06 (0.51)
	CONTROL	0.04 (0.54)	0.04 (0.51)	0.21 (1.20)
Cannabis harms	CLIMATE	0.28 (1.02)	0.22 (0.97)	0.17 (0.74)
	CONTROL	0.19 (0.87)	0.11 (0.71)	0.13 (0.63)
Positive attitudes towards cannabis	CLIMATE	2.22 (3.58)	1.96 (4.46)	2.25 (3.71)
	CONTROL	2.04 (3.19)	1.82 (3.16)	2.53 (4.07)

Intervention effects

Hierarchical linear modelling (HLM) was used as the primary statistical method of analysis to account for intracluster correlations (ICC) between schools [266]. If the unconditional hierarchical linear model revealed that less than 10% of systematic variance existed at the school level, HLM was abandoned and single-level analyses were used [267]. This is because drug use is multidimensional and with limited power HLM can potentially be too conservative to detect differences when the ICC is below 10% [268].

The outcome variables with ICCs under 10% included average weekly alcohol consumption, frequency of drinking to excess on a single occasion in the past three months, cannabis attitudes, frequency of cannabis use in the past three months, and cannabis-related harms. Each of these outcome variables were not normally distributed, therefore change scores were used in the analyses as they better represented normal distributions. Change scores also allowed for the differences between groups at baseline to be taken into account. For the variables with ICCs under 10%, ANOVAs utilising SPSS Generalised linear modelling (GLM) procedure were conducted to examine the difference between groups on change scores (not the difference between groups on a single survey occasion) from baseline to each follow-up occasion. Bonferroni adjustments were made for multiple comparisons. Table 4 provides the mean change scores and standard errors for the CLIMATE and CONTROL groups for all outcome measures from baseline to immediate post, and from baseline to the six-month follow up.

Table 4: Mean change scores (and standard errors) for outcome data from baseline to each follow up occasion

Outcome measures	Group	Baseline to Post	Baseline to six month follow up
Alcohol knowledge	CLIMATE	2.41 **	2.37 **
		(0.40)	(0.26)
	CONTROL	0.54	0.74
		(0.29)	(0.29)
Average weekly alcohol consumption	CLIMATE	0.86	-0.88 *
		(1.68)	(0.91)
	CONTROL	0.24	2.67
		(0.75)	(1.09)
Frequency drinking to excess on a single occasion	CLIMATE	-0.08	0.32
		(0.28)	(0.18)
	CONTROL	-0.11	0.23
		(0.21)	(0.11)
Alcohol harms	CLIMATE	3.07	0.34
		(3.15)	(1.63)
	CONTROL	-1.19	2.73
		(1.51)	(1.47)
Positive alcohol-related expectancies	CLIMATE	0.03	0.48
		(0.46)	(0.34)
	CONTROL	0.49	1.20
		(0.39)	(0.38)
Cannabis knowledge	CLIMATE	2.88 **	1.83 **
		(0.43)	(0.31)
	CONTROL	0.54	0.33
		(0.37)	(0.35)
Frequency of cannabis use	CLIMATE	0.08	-0.06 *
		(0.11)	(0.07)
	CONTROL	-0.04	0.20
		(0.07)	(0.09)
Cannabis harms	CLIMATE	0.00	-0.04
		(0.13)	(0.08)
	CONTROL	-0.16	-0.03
		(0.10)	(0.09)
Positive attitudes towards cannabis	CLIMATE	0.33	0.20
		(0.46)	(0.32)
	CONTROL	-0.26	0.16
		(0.37)	(0.41)

* Significant difference between groups at 0.05

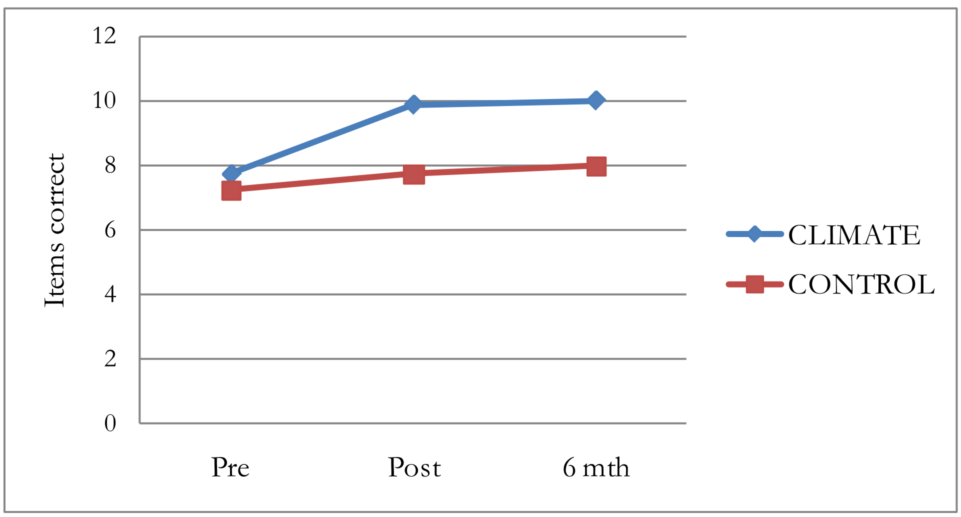
** Significant difference between groups at 0.01

Alcohol-related outcomes

Alcohol-related knowledge

The unconditional hierarchical linear model had knowledge scores centred at post-test. A linear growth term was utilised to characterise the pattern of change in knowledge over time. The variation between schools accounted for 24% of total explainable variance in knowledge scores at post-test. Intervention condition was added to the model as a school-level predictor and was found to significantly improve model fit (χ^2 (2) = 17.27, $p < 0.05$). The population mean across all schools was 7.62 with the intervention group scoring significantly higher (1.44 units) on the alcohol knowledge scale than students in the control group at post-intervention (t (8) = 7.99, $p < 0.001$). The average growth in knowledge scores across all schools was 0.25 units/occasion with the intervention group demonstrating a further 0.99 units/occasion (t (8) = 3.23, $p < 0.01$). The inclusion of intervention effects explains 99% of the variance in post-test knowledge scores. Figure 2 shows the change in knowledge scores over time.

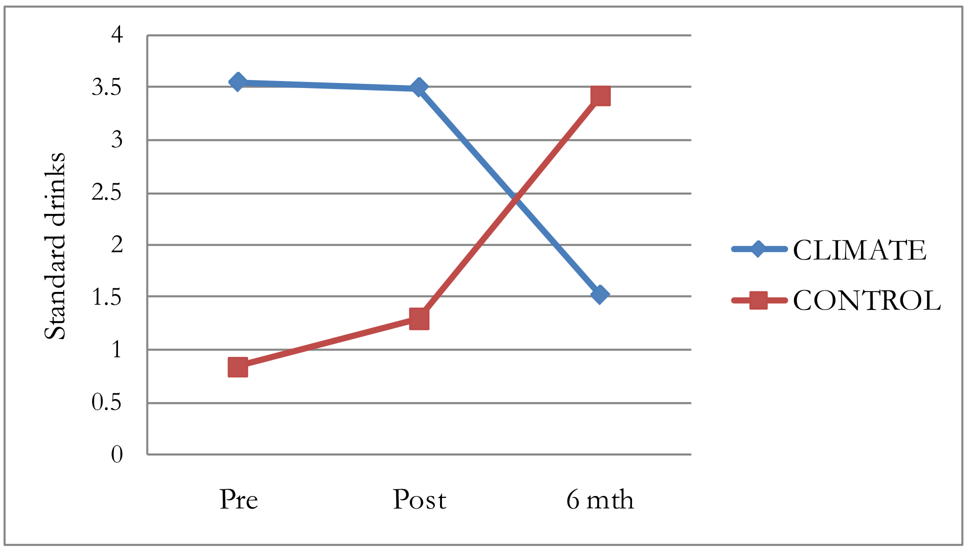
Figure 2: Alcohol knowledge in the CLIMATE and CONTROL groups over time



Average weekly alcohol consumption

Baseline to immediate follow up showed no significant difference between groups in average weekly alcohol consumption ($F(1,341) = 0.13$, $p = 0.72$). At six month follow up there was a significant difference, with the control group increasing their average consumption (mean difference=2.67 standard drinks) significantly more than the intervention group (mean difference=-0.88 standard drinks) ($F(1,400) = 6.28$, $p < 0.05$). Figure 3 shows the change in average weekly alcohol consumption for the intervention and control groups over time.

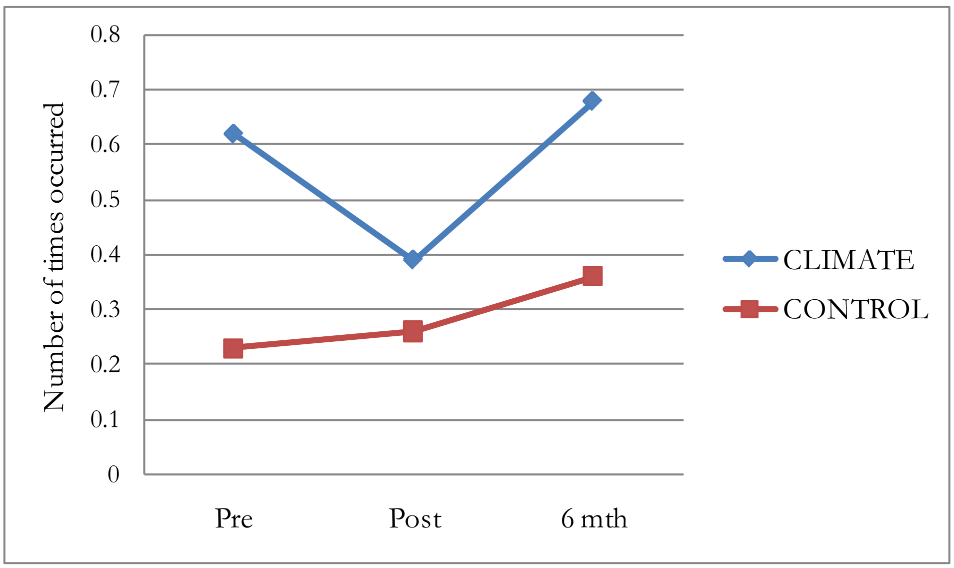
Figure 3: Average alcohol consumption in the CLIMATE and CONTROL groups over time



Frequency of drinking to excess on a single occasion in the past three months

From baseline to immediate follow-up there was no significant difference between groups in their frequency of drinking to excess ($F(1, 335) = 0.01$, $p = 0.93$). At the six-month follow up, again, there was no significant difference between groups on frequency of drinking to excess ($F(1,397) = 0.16$, $p = 0.69$). Figure 4 shows the change in drinking to excess for the intervention and control groups over time.

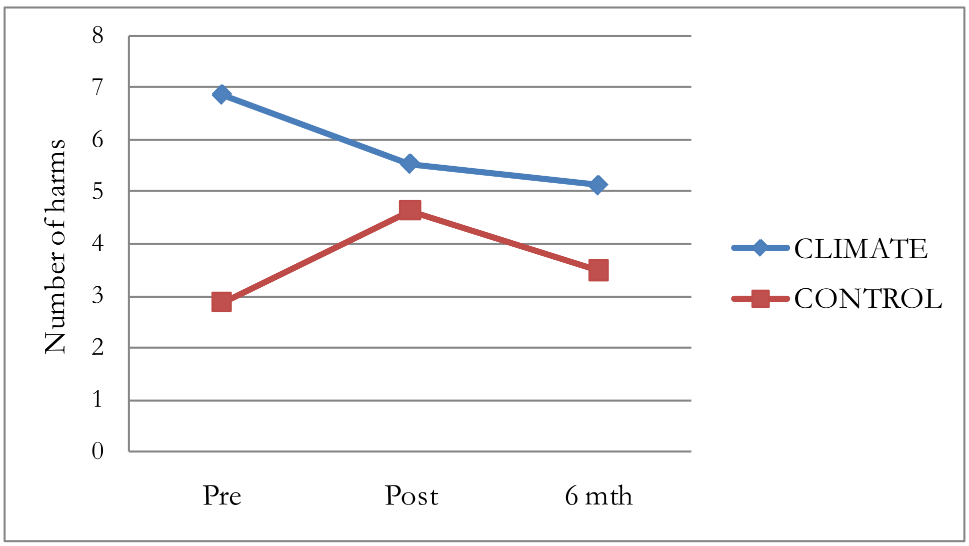
Figure 4: Frequency of drinking to excess in the CLIMATE and CONTROL groups over time



Harms associated with own use of alcohol

The unconditional hierarchical linear model had alcohol-related harms centred at post-test. A linear growth term was utilised to characterise the pattern of change in alcohol-related harms over time. The variation between schools accounted for 11% of total explainable variance in harm scores. Intervention condition was added to the model as a school-level predictor, but was not found to be a significant predictor of alcohol-related harms ($t(8) = 1.46$, $p = 0.18$ (intercept); $t(8) = 0.13$, $p = 0.90$ (slope)). Figure 5 shows the change in knowledge scores for the intervention and control groups over time.

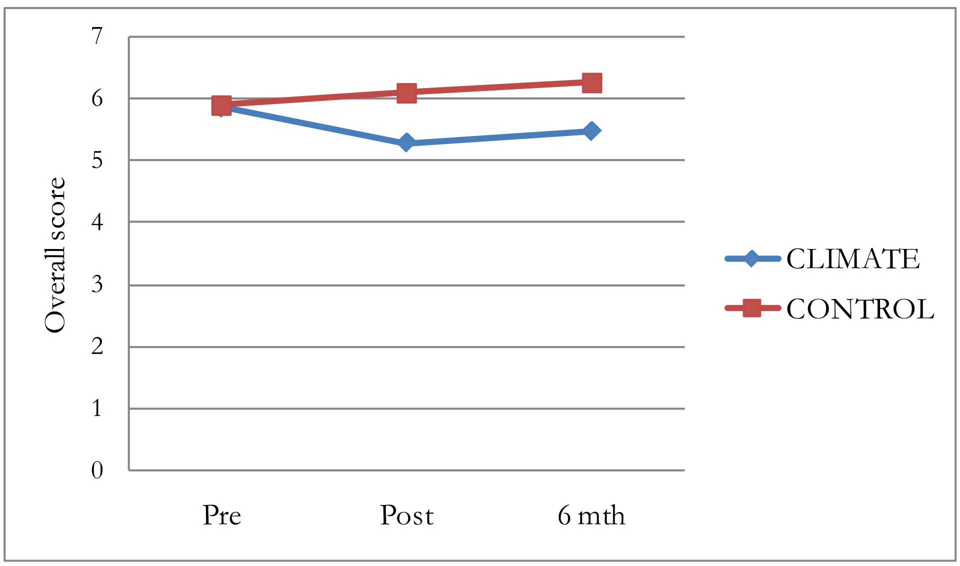
Figure 5: Alcohol-related harms in the CLIMATE and CONTROL groups over time



Alcohol-related expectancies

The unconditional hierarchical linear model had alcohol-related expectancy scores centred at post-test. A linear growth term was utilised to characterise the pattern of change in expectancy scores over time. The variation between schools accounted for 16% of total explainable variance in expectancy scores. Intervention condition was added to the model as a school-level predictor, but was not found to be a significant predictor of alcohol-related expectancies ($t(8) = 0.29$, $p = 0.78$ (intercept); $t(8) = -0.87$, $p = 0.46$ (slope)). Figure 6 shows the change in alcohol expectancy scores for the intervention and control groups over time.

Figure 6: Alcohol-related expectancy scores in the CLIMATE and CONTROL groups over time

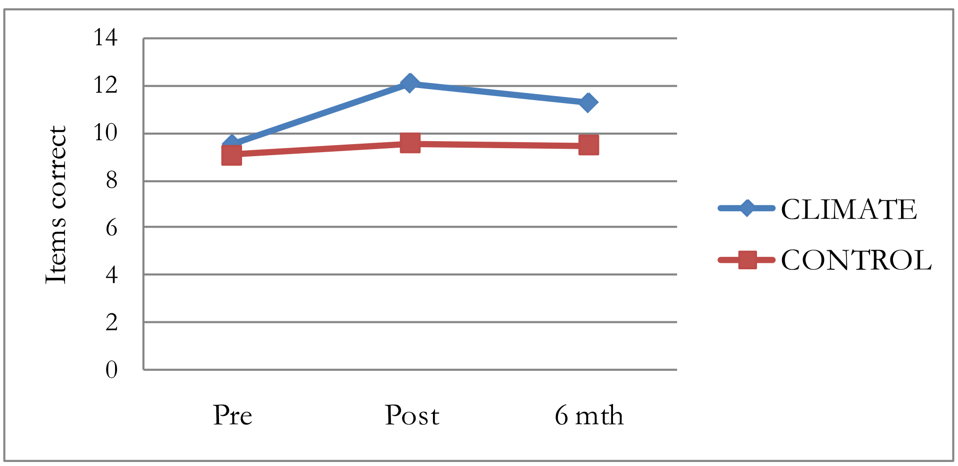


Cannabis-related outcomes

Cannabis-related knowledge

The unconditional hierarchical linear model had cannabis knowledge scores centred at post-test. A linear growth term was utilised to characterise the pattern of change in knowledge over time. The variation between schools accounted for 16% of total explainable variance in cannabis knowledge scores at post-test. Intervention condition was added to the model as a school-level predictor and was found to significantly improve model fit (χ^2 (4) = 36.38, $p < 0.05$). The population mean across all schools was 9.34 with the intervention group scoring significantly higher (1.33 units) on the cannabis knowledge scale than students in the control group at post-intervention (t (8) = 5.90, $p < 0.001$). The average growth in knowledge scores across all schools was 0.18 units/occasion, with the intervention group demonstrating a further 0.76 units/occasion (t (8) = 2.52, $p < 0.05$). The inclusion of intervention effects explains 92% of the variance in post-test knowledge scores. Figure 7 shows the change in knowledge scores for groups over time.

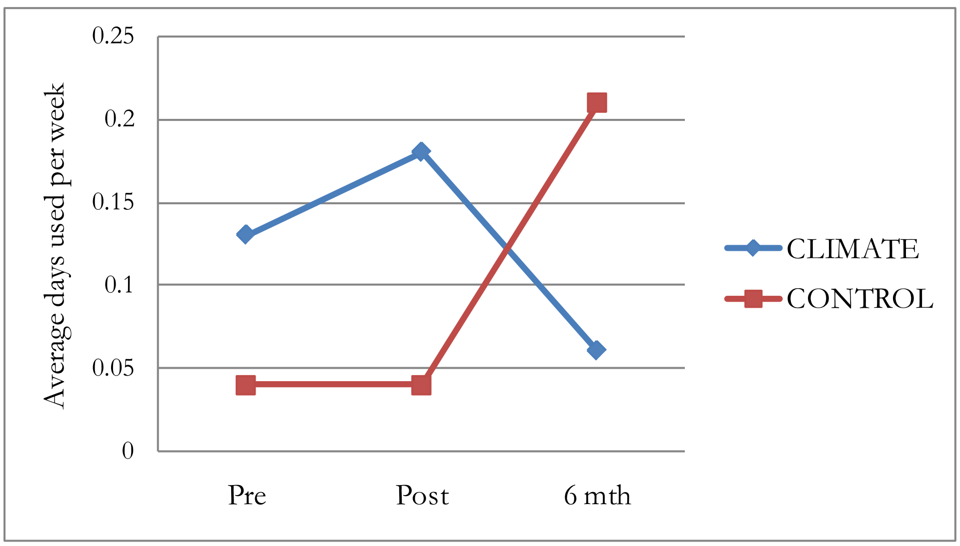
Figure 7: Cannabis knowledge in the CLIMATE and CONTROL group over time



Frequency of cannabis use in the past three months

From baseline to immediate follow up there was no significant difference between groups in frequency of cannabis use ($F(1,341) = 0.94$, $p = 0.33$). From baseline to the six-month follow up, there was a significant difference between groups, with the intervention group decreasing its frequency of cannabis use (mean difference=-0.06 times/week) compared to the control group (mean difference=0.20 times/week) ($F(1,400) = 5.25$, $p < 0.05$). Figure 8 shows the change in frequency of cannabis use for the intervention and control groups over time.

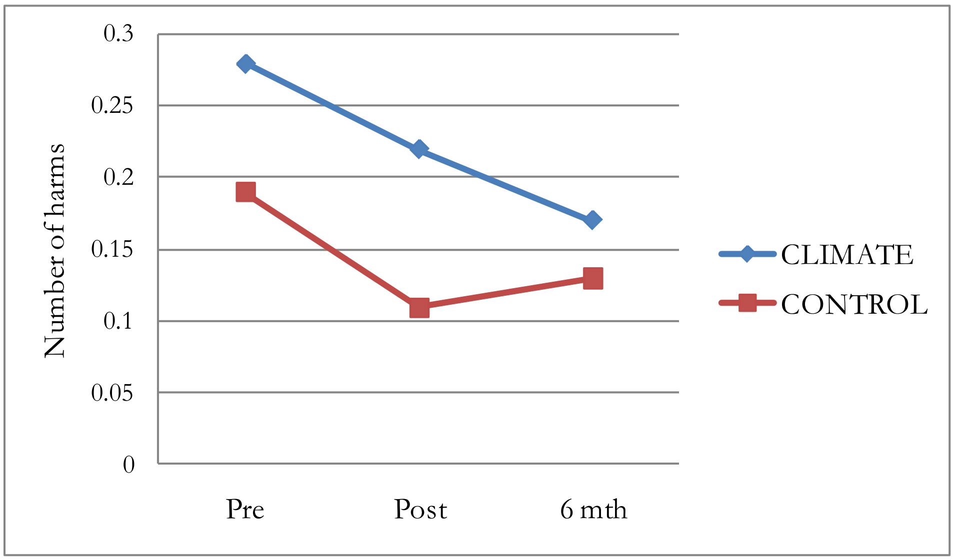
Figure 8: Frequency of cannabis use in the CLIMATE and CONTROL group over ime



Cannabis harms

There was no significant difference between intervention and control groups in change of cannabis harms scores from baseline to immediate follow up ($F(1, 276) = 0.94$, $p = 0.33$). At the six-month follow up, again, there was no significant difference between groups in attitudes to cannabis ($F(1,363) = 0.01$, $p = 0.96$). Figure 9 shows the change in cannabis harms for the intervention and control groups over time.

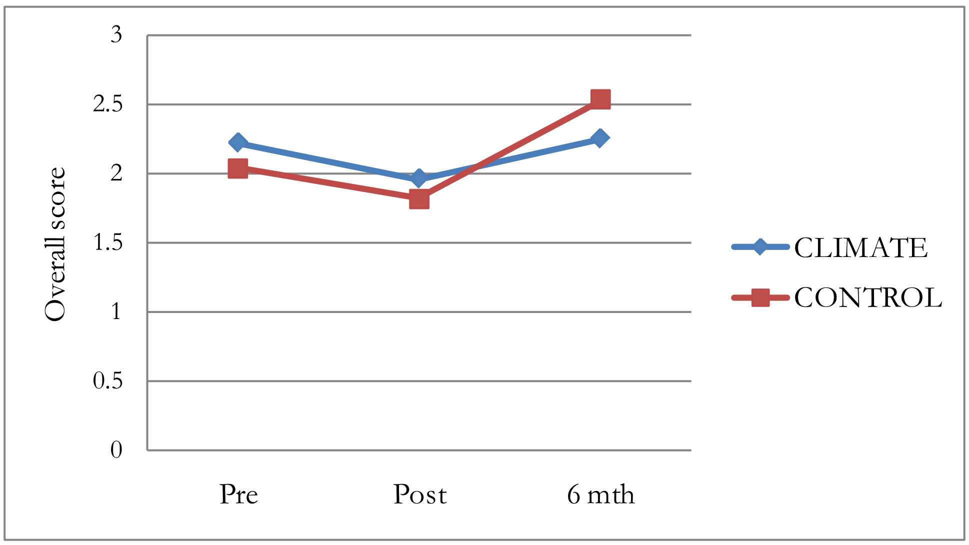
Figure 9: Cannabis-related harms in the CLIMATE and CONTROL group over time



Cannabis attitudes

There was no significant difference between intervention and control groups in change of cannabis attitudes from baseline to immediate follow up ($F(1, 271) = 1.01$, $p = 0.32$). At the six month follow up, again, there was no significant difference between groups in attitudes to cannabis ($F(1,364) = 0.01$, $p = 0.94$). Figure 10 shows the change in cannabis attitude scores for the intervention and control groups over time.

Figure 10: Cannabis attitude scores in the CLIMATE and CONTROL groups over time



Evaluation of the Climate Schools: Alcohol and Cannabis Course

To evaluate the Climate Schools: Alcohol and Cannabis Course, log books and evaluations were collected from teachers who delivered the course, and evaluations were collected from students who completed the course.

Teacher log books

Log books were completed by the teachers who administered the Climate Schools: Alcohol and Cannabis Course providing information on what activities they chose to deliver for each lesson and any comments or concerns they had regarding the activities. Teachers were also asked to indicate whether or not they gave their students a copy of the 'student summary' for each lesson which was contained in the Teacher's Manual.

For all lessons in the Climate Schools: Alcohol and Cannabis Course, half to three-quarters of the teachers provided students with the summary sheets and they believed the summaries were a great way to reinforce the information taught in the activities. Teachers varied widely in which, and how many activities they completed with their classes. Overall, the feedback from teachers concerning the activities was very positive and they believed the activities related well to the syllabus and were a great way for students to apply and discuss the information presented in the cartoons.

Student evaluation of the program

<u>Participants and procedure</u>

Students from one class in each school that completed the Climate Schools: Alcohol and Cannabis Course were randomly chosen to evaluate the program (n=98). The evaluation questionnaire comprised 10 items relating to how enjoyable, interesting and effective students thought the cartoons and activities of the program were in teaching drug education. Students were asked to indicate on a seven-point likert scale how much they agreed with each statement, with one indicating 'strongly agree' and seven indicating 'strongly disagree'.

Results from student evaluations

The vast majority of students agreed or strongly agreed the cartoon story was an enjoyable way of learning (92.9%) and helped to maintain their interest while learning (88.8%). Most students (88.5%) agreed that the cartoon stories were relevant to their current or future life experiences and most (84.7%) indicated they planned to use the information in their own lives.

Almost all the students (93.9%) indicated that the information on alcohol and cannabis and how to stay safe was easy to understand and to learn, and 89.8% indicated that it was easy to remember. In terms of the lesson activities which accompany the cartoon stories, 87.6% of students thought the activities helped them to further understand the information being taught, and 85.7% thought the classroom activities helped them apply the information they learnt in the cartoons to their own life. Further, the vast majority of students (88.8%) indicated they would like to learn other PDHPE theory topics through cartoon stories.

Teacher evaluation of the program

Participants and procedure

Twelve teachers who implemented the Climate Schools: Alcohol and Cannabis Course were randomly chosen to evaluate the program. Teachers ranged from 25 to 60 years of age, with a mean age of 37.33 years (SD=11.16). Three quarters were male (66.7%) and the average teaching experience was 14.08 years (SD=12.78), ranging from one to 39 years. The teacher evaluation questionnaire comprised 15 items assessing overall ratings of the characteristics of the program, classroom activities, teacher manual, and additional comments regarding ways to improve the Climate Schools: Alcohol and Cannabis Course.

Results from teacher evaluations

Computer component: The majority of teachers reported that the cartoons were effective in holding the students' attention, with two-thirds responding that it held their attention 'very well' (33%) or 'well' (33%). The remaining third reported the cartoon story to be 'average' in holding students' attention. No teachers reported it to be 'poor' or 'very poor'. The majority of teachers reported that students were able to recall the information on alcohol and cannabis after the cartoon story either 'well' (17%) or 'very well' (67%). No teachers reported recall to be 'poor' or 'very poor'. Ninety-two percent of teachers endorsed that students liked the program 'a lot' (67%) or 'a little' (25%), and only one teacher indicated that the students thought it was 'average'. Some teachers believed that the cartoon content was more suitable for the less able students than the more able students in being an effective way to teach drug education.

Implementation: In terms of implementing the computer-based program, the majority of teachers reported it was 'very easy' (25%) or 'easy' (42%) to implement, and 17% reported 'average' levels of ease. Two teachers thought it was 'difficult to implement' and the reasons given for this were because the they had difficulty installing/downloading the program and students read the cartoons at different paces, making it difficult to monitor. When asked about ease in gaining access to computer facilities to run the classes, half the teachers reported it was either 'easy' (25%) or 'very easy' (25%) to gain access to computers. The remaining teachers reported 'average ease' (42%) or 'difficulty' (8%) in gaining access to computers.

Teacher manual and activities: The vast majority of teachers rated the educational quality of the classroom activities positively, with 58% indicating it was 'good' and 33% indicating it was 'very good'. Two-thirds of teachers reported that the activities were 'very easy' to prepare, and 25% reported they were 'easy' to prepare. All teachers believed that the additional classroom activities helped to reinforce the information 'well' (83%) or 'very well' (17%).

Overall program: Three quarters of teachers rated the overall Climate Schools: Alcohol and Cannabis Course as 'good' (33%) or 'very good' (42%). One-quarter reported that it was 'average', and no teacher said it was 'poor'. The vast majority of teachers (91%) reported that the course met the outcomes of the PDHPE syllabus 'well' (25%) or 'very well' (58%). No teachers reported that the program complied poorly with the syllabus.

Seventy-two percent of teachers endorsed the program as 'better' (42%) or 'much better' (25%) than other education programs. Eight percent rated the program as 'average' in comparison to other programs and 17% rated it as 'worse than other programs'. Reasons given for this were because teachers found the resources too large and too comprehensive at times. Teachers also commented about the cartoons being enjoyable to students but not taken seriously at times.

Three-quarters of the teachers reported it was either 'likely' (17%) or 'very likely' (58%) that they would use the Climate Schools: Alcohol and Cannabis Course in the future. Likewise, three-quarters of teachers said it was either 'likely' (25%) or 'very likely' (50%) that they would recommend the course to other teachers.

Discussion

The aim of the current chapter was to assess whether the integrated Climate Schools: Alcohol and Cannabis Course, which addresses the need for sequential and developmentally appropriate school-based prevention [13, 14], was effective in decreasing alcohol and cannabis use, and was acceptable to both students and teachers as a means of delivering licit and illicit drug education.

Schools in the present study were randomly allocated to alcohol and drug education as usual or to the Climate Schools: Alcohol and Cannabis Course, an internet-based course that spanned six months (lessons on alcohol misuse followed six months later in the school year with lessons that reprised the alcohol information and then taught information about cannabis misuse). Students completed online self-reported questionnaires at baseline, immediately after the course had been completed, and again six months later.

Consistent with other prevention studies which have focused on harm-minimisation, as opposed to abstinence-based messages, the results of the current study attest to the program being an effective and acceptable approach in addressing alcohol and cannabis use [11, 20, 90, 110]. The integrated Climate Schools: Alcohol and Cannabis Course was related to increases in alcohol and cannabis knowledge both immediately post the intervention and at the six-month follow up. In terms of behavioural change, compared to students in the control group, students who received the Climate Schools intervention demonstrated decreases in average alcohol consumption and decreases in frequency of cannabis use six months following the intervention.

The latter is of particular importance because frequency of cannabis use has been found to predict later development of cannabis dependence [269, 270], which, apart from increasing the risk of using other illicit drugs [271], is also associated with significant negative long-term health effects [272, 273].

Although no significant difference was found between the groups on frequency of drinking to excess, the effect was in the anticipated direction, with the intervention group reducing their binge drinking immediately after the intervention. Further analysis using a larger sample may detect significant differences. In addition, future studies would benefit from recruiting a larger number of schools to provide the power to examine other important individual level (such as gender), and school level (such as socio economic status) predictors in the HLM models.

Field-testing points to the need to make some changes in order to impact on harms associated with alcohol and cannabis use. In terms of cannabis-related harms, the lack of significant differences between the control and intervention groups could be a result of the very small proportion of participants in both the intervention and control groups whom reported using cannabis. As such, it is safe to say that the vast majority have not been exposed to the consequent harms and problems relating to cannabis use. As exposure and use increases, differences between groups on harms experienced may also increase. In addition, these results are consistent with those of the SHAHRP study from which the alcohol harms measure was taken, which did not see significant differences between groups on these harms until 12 months following the intervention [110]. Further planned analysis of 12 month data will address this issue once the skills and knowledge taught by the program have become of increased relevance to young people's lives.

No differences were found between the groups on the measures of alcohol and cannabis expectancies and attitudes; however, it is important to note that both groups had low or negative attitudes towards these drugs to begin with. Further, school-based prevention literature has previously shown that impacts of interventions commonly have delayed effects and often become evident months or years following an intervention. One study in particular found no change in alcohol attitudes until two years after an intervention and no change in cannabis attitudes until three years after the intervention [122]. Again, planned analysis of 12-month data will address this issue.

In the current study, the relatively small follow up rate of 48% and 69% immediately post the intervention was not ideal. This may have resulted from the difficulty in linking confidential data from internet-based surveys over time. The follow up rates of 86% and 78% at the six month follow-up were, however, consistent with those of larger trials [11, 274] and the sample size was large enough to provide adequate power to detect differences between groups. As technology advances, so may the availability of techniques to more effectively link confidential data over the internet.

Overall, this study found the innovative design of the Climate Schools: Alcohol and Cannabis Course, which addresses the need for sequential and developmentally appropriate prevention, to be effective in increasing alcohol- and cannabis-related knowledge, decreasing frequency of cannabis use and decreasing average alcohol consumption. In addition, students and teachers rated the internet-based course as an acceptable means of teaching drug education, both licit and illicit, and overcoming the traditional obstacles associated with implementation of school-based prevention programs, thus providing a promising framework for the provision of prevention programs in the future.

The challenge remains to see if a harm-minimisation approach will also be acceptable and effective for the prevention of less prevalent illicit drugs such as meth/amphetamine and ecstasy. This will be the focus of Chapter 6.

Chapter 6: The efficacy of CLIMATE Schools: Psychostimulant and Cannabis Module

Introduction

The RCT used to evaluate the feasibility and effectiveness of the CLIMATE Schools: Psychostimulant and Cannabis Course is described in this chapter. Prior to proceeding with reporting this evaluation, the following section briefly recaps the background to this research.

Early initiation to drug use is associated with a range of negative consequences including substance use disorders, co-morbid mental health problems, juvenile offending, impaired educational performance and early school drop-out, resulting in negative impacts on both current functioning and future life options [1-3]. School-based prevention programs are ideally placed to access a vulnerable population of young people before significant drug use problems develop [4, 27, 29, 82, 83]. Such programs do exist, but the outcomes of school-based program are often compromised by implementation failure [9, 195-197]. In addition, the majority of drug prevention programs originate in the United States which has an abstinence-based, rather than harm-minimisation focus [5, 7, 96, 137]. A growing body of evidence suggests that harm-minimisation programs for drug use could potentially be more effective as they provide greater scope for preventive information and skills, whilst catering for all young people irrespective of levels of use [10-12]. Hence the aim of the current research was to develop a series of drug prevention programs which were underpinned by a harm-minimisation framework[2] and were designed in such a way as to overcome problems with implementation. Prevention programs delivered utilising computer technology have the potential to overcome such obstacles, by guaranteeing complete, consistent and interactive delivery on every occasion.

The first step in addressing these limitations was to develop a computer-based harm-minimisation intervention[2] aimed at reducing alcohol consumption and harms among young people, titled CLIMATE Schools: Alcohol Module [35]. This module was evaluated using a cluster RCT and was found to be effective in increasing alcohol-related knowledge of facts that would inform safer drinking choices, and in decreasing the positive social expectations which students believed alcohol may afford. For females, the program was effective in decreasing average alcohol consumption, alcohol-related harms and the frequency of drinking to excess (> 4 standard drinks; 10g ethanol). For males, the behavioural effects were not significant [11]. The results of this module were promising and provided the impetus to assess if this innovative new platform of delivery for school-based drug prevention could be extended to other drugs of concern in adolescence.

Psychostimulants and cannabis have emerged as the most commonly used illicit drugs in Australia [149] and are two of the three most commonly used illicit drugs by young

Australians (the other being inhalants) [41], providing a compelling argument to develop a new CLIMATE Schools module for these substances, based on the same principles as the alcohol module. Hence, the aim of the current research is to utilise a cluster RCT controlled trial to assess the feasibility and effectiveness of this new module, titled CLIMATE Schools: Psychostimulant and Cannabis Module.

Transferring this platform of delivery to illicit drugs does lead to a number of additional challenges. Despite Australia's National Drug Strategy advocating a harm-minimisation[6] approach to drug use [250], there is greater concern and less knowledge in the community regarding illicit, rather than licit drug use [275], which may result in this program being less acceptable within the school setting. Experience with the CLIMATE Schools: Alcohol and Cannabis Module [276] (Chapter 5), however, found it to be both acceptable and effective for the most prevalently used illicit drug, namely, cannabis. Specifically, both teachers and students rated this program positively and it was effective in decreasing average alcohol consumption and the frequency of cannabis use six months after the intervention [12]. These results not only suggest that using such an approach is acceptable, but may also lead to a greater range of possible prevention outcomes. The aim of the current study was to assess if this innovative new platform of delivery can feasibly be extended to a module which addresses illicit drugs, as well as addresses psychostimulants which are even less prevalent and potentially less acceptable in society than cannabis. Hence, the aim of the current chapter is to assess whether:

- It is both feasible and acceptable to deliver a computer-based harm-minimisation[1] program for the prevention of cannabis and psychostimulant use and misuse; and
- It is effective in decreasing cannabis and psychostimulant use

6 It is important to be clear, that consistent with a harm-minimisation framework, the harm-minimisation message adopted in the current program was to strongly encourage abstinence as a desirable outcome, but also accept that some young people will use drugs and, hence, provide information and skills to attempt to minimise or prevent the consequences or effects of alcohol and other drug use on both the individual and society.

Method

Design

A longitudinal cluster RCT was utilised to evaluate the efficacy and feasibility of the CLIMATE Schools: Psychostimulant and Cannabis Module. Of a total 21 schools, Year 10 students (Mean age: 15.44 years) from 11 schools were randomly allocated to receive the CLIMATE Schools: Psychostimulant and Cannabis Module (CLIMATE) (n=906, 57.9% Male), whilst the classes from the other eight schools received their usual PDHPE classes (CONTROL) (n=828, 75.2% Male). Students in both the CLIMATE and CONTROL groups completed surveys on four separate occasions. These surveys were completed at baseline, immediately after the intervention had been received by the CLIMATE group, and at five months post intervention, and at 10 months post intervention. An overview of the study design is presented in Table 5.

Table 5: Overview of study design

	Baseline	Intervention	Post	5 month follow-up	10 month follow-up
Timing	Term 2 March-April 2008	Term 2&3 April-June 2008	Term 2&3 June-August 2008	Term 4 October – November 2008	Term 2 March-June 2008
CLIMATE	Survey 1	CLIMATE Intervention	Survey 2	Survey 3	Survey 4
CONTROL	Survey 1		Survey 2	Survey 3	Survey 4
Mean Age in years	15.44 (SD=0.41)		15.69 (SD=0.41)	15.96 (SD=0.42)	16.37 (SD=0.41)

* The post survey was completed immediately after the CLIMATE intervention was delivered

Recruitment of schools

Members of the research team initially presented the CLIMATE Schools: Alcohol Module results at a number of different school area meetings for both the Catholic and Independent School systems. School staff who attended these meetings were asked to provide their names and contact details if they were interested in being involved in the development of the CLIMATE Schools: Psychostimulant and Cannabis Module. In total, staff from 30 different schools expressed an interest and a number of these were involved in the development of the module. Later, all 30 schools were contacted to determine their interest in being involved in the evaluation of the CLIMATE Schools: Psychostimulant and Cannabis Module. Twenty-two schools showed an interest; 21 agreed to be involved. PDHPE curriculum coordinators from each school were required to gain permission from the school executive prior to being admitted to participate in the trial. Written informed consent was obtained from each individual classroom teacher who would be participating in the trial and providing evaluation data. Classroom teachers were reimbursed $100 for the extra time required for the dissemination and collection of student and parent consent forms and also for the completion of lesson log books and the CLIMATE evaluation survey.

Sample

A total sample of 1734 Year 10 students from 21 Independent and Catholic High Schools in NSW and the ACT participated in this project at baseline. The mean age of students at baseline was 15.44 years (SD=0.41) and 66.2% were male. The sample of schools included four co-educational schools, 11 schools for boys only, and six schools for girls only. The number of students participating in the trial varied substantially between schools, ranging from 18 to 140 (Mean 82.57, SD. 34.26).

Follow-up rates

Of the sample of 1734 students who completed the survey at baseline, the follow-up rate was 69.7% at post-test, 61.4% at five months post intervention and 56.1% at 10 months post intervention. A total of 651 students (n=37.5%) had data for all four survey occasions. The number and percentage of students followed over time is presented in Figure 11.

Attrition resulted from a number of different factors. First, one control school withdrew from participation after the baseline survey. The reason given for withdrawing was that the teacher who had been co-ordinating their involvement in the trial had left the school and other teachers did not want to take responsibility for the additional workload. At the three-month follow-up survey occasion, one CLIMATE school could only provide access to survey two of the four participating classes due to time constraints. The final survey occasion occurred in Term 2 of Year 11. The follow-up rate on this occasion is much lower because a number of students had left the schools they were attending at the end of Year 10 when they had completed their school certificates. The remaining attrition resulted from the following factors: (1) students being absent on the day of the survey, (2) students no longer attending the school at the time of the survey, (3) students failing to maintain the same identifier code, and (4) students whose surveys were excluded as they had failed to include unique identifier codes or had not answered the questions.

Figure 11: Flow chart of recruitment and participation of schools

Approached to participate:
30 schools

Agreed to participate:
21 schools
Total students: 2309
Consented: 1839 (79.6%)
No consent: 178 (7.7%)
No return: 302 (13.1%)

Allocated to CLIMATE 11 Schools 1198 students Consent: 962 (80.3%) No consent: 88 (7.3%) No return: 148 (12.4%)	**Allocated to CONTROL** 10 Schools 1121 students Consent: 877 (78.2%) No consent: 90 (8.0%) No return: 154 (13.7%)
Baseline 11 Schools Eligible students: 962 Completed Surveys: 906 (94.2%) Lost to follow-up: 56 (5.8%)	**Baseline** 10 Schools Eligible students: 877 Completed Surveys: 828 (94.4%) Lost to follow-up: 49 (5.6%)
Immediate follow up 11 schools Completed surveys: 846 Repeat Surveys: 628 (69%)* Linked surveys: 628 (69%)*	**Immediate follow up** 9 schools Completed surveys: 706 Repeat Surveys: 580 (70%)* Linked surveys: 580 (70%)*
5 months follow up 11 schools Completed surveys: 817 Repeat Surveys: 614 (68%)* Linked surveys: 499 (55%)*	**5 months follow up** 9 schools Completed surveys: 569 Repeat Surveys: 450 (54%)* Linked surveys: 386 (47%)*
10 months follow up 11 schools Completed surveys: 744 Repeat Surveys: 570 (63%)* Linked surveys: 396 (44%)*	**10 months follow up** 9 schools Completed surveys: 565 Repeat Surveys: 403 (49%)* Linked surveys: 255 (31%)*

* %s in comparison to those who completed baseline surveys
* Repeat surveys represent students with data at time 1 and the single further testing occasion
* Linked surveys represent students who have completed a survey for each time point up until the current occasion.

Procedure

Ethics

Ethics was sought and received from the University of New South Wales Human Research Ethics Committee prior to the commencement of the present research.

Staff recruitment and training

Seventeen research assistants were employed to assist with the data collection in schools, all had undergraduate degrees in the health sciences/humanities or relevant experience. Completion of a Prohibited Employment Check ensuring prospective employees had not previously been found guilty of a serious child-related offence was a condition of employment.

All research assistants were provided with a single training session to ensure consistent administration of the survey instrument. Written instructions regarding survey administration were also provided to all staff.

Parent and student consent

Informed consent was obtained from both parents and students to participate in the present study. This consent pertained to the collection of survey data. Consent was not required for students to be taught the CLIMATE Schools: Psychostimulant and Cannabis Module because the program content was part of the standard school curriculum, just delivered in a novel format. This ensured that should some students and parents refuse consent their children could still participate in usual classes and no special alternative arrangements would be required.

Survey data collection

Survey data was either collected in single classroom settings, or the entire year group completed the survey in the school hall. Research staff administering the survey followed a standardised protocol.

The anonymous and confidential nature of the survey was stressed and explained to students on a number of occasions to encourage honest responding. In order to make salient to students the genuine nature of the confidentiality and anonymity of surveys, a number of other measures were implemented. First, students were not required to write their names on surveys. If they did accidentally write their names on the surveys they were told to ask for a new survey battery. Unique identification codes were utilised rather than names to permit linkage of baseline, post test and follow-up responses (i.e., first letter of mother's name, date of day born and last letter of first name, gender, number of older siblings and country of birth). Students were assured that none of these questions could lead to their direct identification. Secondly, students were informed that the results of this research, which would be provided to schools and students on completion of the study, would never identify students or schools. Rather, all data would be collapsed across all schools participating in the project. Thirdly, although in the majority of schools the classroom teacher was mandated to remain in the room, school administrators and teachers were not involved in any of the data collection activities. Fourthly, any questions students asked regarding questions in the survey were addressed using a blank survey instrument to illustrate to students that even research staff would be blind to their individual responses. This procedure was made clear to students from the outset to encourage students to clarify any questions or issues. Finally, students were asked to seal their questions in an envelope, prior to the survey instrument being collected, again to reinforce to students that the research staff could not link any survey response to the students in the moment.

In an effort to maximise comprehension, the instructions for each section of the survey were read out to the class and clearly explained. Students were encouraged to ask questions to clarify their understanding of the questions. The survey took students a maximum of 40 minutes to complete, approximately corresponding to the minimum length of one class period in schools. Once students had completed the surveys, they were thanked for their time and encouraged to ask any questions. Two movie tickets were raffled per class to thank students for their time. The raffle included both students who did and did not have consent to participate in the research. This was done to ensure that students were not inadvertently coerced into remaining in the study solely to receive a movie ticket when in fact they would otherwise have withdrawn from the study. No attempt was made to follow up with students who were away on the day of testing because repeated school visits may have resulted in schools no longer wishing to participate due to excessive demands on teacher time for coordination and class time for students. A copy of the RCT results will be provided through schools to interested students in the year group upon completion of this report.

Teacher training

Teachers were not provided with any formal training on alcohol and other drug education or on how to deliver the CLIMATE Schools: Psychostimulant and Cannabis Module in their classrooms. Rather, each teacher was provided with a Teacher Manual for the program [277]. This manual was designed to provide a brief and clear guide for teachers to implement the program. It was designed so that teachers could prepare for a class lesson in less than 10 minutes and that relieving teachers could readily continue the program in the usual teacher's absence. For each lesson, the manual provided lesson summaries for teachers, lesson summaries for students, prepared student activities and overheads. This program was designed in such a way to potentially stand up to the limitations required by routine school practice. Specifically, most schools do not provide teachers with training prior to running drug prevention programs in schools [82]; hence, in the current research, training was not provided. Specifically, the aim of this evaluation was to assess the feasibility and efficacy of implementing a drug education program in a real-world educational setting.

CLIMATE intervention

The CLIMATE Schools: Psychostimulant and Cannabis Module consists of a six-lesson harm-minimisation[7] program aimed at decreasing cannabis and psychostimulant use, misuse and related harms. Each lesson is approximately 40 minutes in length; the full details of the topics covered in each lesson are listed in Table 6. Each of the six lessons is broken into two components. The first is a 15-20 minute computer module. The second part involves the choice of one or more classroom-based activities which have been prepared in the program manual. Teacher and student summary sheets are also provided for each lesson.

[7] It is important to be clear that, consistent with a harm-minimisation framework, the harm-minimisation message adopted in the current program was to strongly encourage abstinence as a desirable outcome, but also accept that some young people will use drugs and hence provide information and skills to attempt to minimise or prevent the consequences or effects of alcohol and other drug use on both the individual and society.

Table 6: Lesson content of CLIMATE Schools: Psychostimulant and Cannabis Module

Lesson	Content
1	Cannabis: What it is? Short term effects of cannabis Reason people use cannabis Cannabis and the law Risk and protective factors for drug use Conservative norms – prevalence of cannabis use Mental health and cannabis
2	Critical analysis of drug-related internet and media resources Classifying drugs: hallucinogens, stimulants and depressants Psychostimulants: What are they? Common names and properties of psychostimulant drugs Short-term effects of psychostimulants Conservative norms: Prevalence of use of psychostimulants The multifaceted nature of the effects of drug use on people's lives
3	Definitions, examples and effects of poly-drug use Classifying drugs The indirect negative consequences of drug use Problem solving and decision making skills in relation to drugs Identifying drug related risk and minimising drug related harms
4	Communication skills Avenues for seeking help and barriers to accessing services What to do in a drug related emergency Calling 000, the emergency number Identifying communication styles, including assertiveness
5	Long-term effects of drugs Drug withdrawal Harm-minimisation strategies Learning about resilience Attitudes to drug use Prevalence of psychostimulants and cannabis use CPR and first aid
6	Drugs and driving Drugs and the law Problem solving skills Legalisation, decriminalisation and criminalization of drugs – the debate The effects of drugs on life's journey The effects of drugs on others

CONTROL school cannabis and psychostimulant prevention education

Eight of the nine schools in the CONTROL condition provided details of the content and timing of the cannabis and psychostimulant education that was provided to students in their schools. This information revealed that three of the control schools delivered a social influence program based on a harm-minimisation approach, one school delivered a harm-minimisation program, but failed to include the component on conservative norms, and four of the eight schools did not cover psychostimulants as a topic at all. Of the four schools who did deliver a drug prevention program, three did so during the study time frame and one delivered the program one year preceding the commencement of this study. Of those who did deliver drug prevention programs for cannabis and psychostimulant use, these programs ranged from eight to 13.5 lessons.

Measures

A 163-item self-report questionnaire was administered to students. The questionnaire assessed cannabis and psychostimulant knowledge, use, harms and attitudes. It also assessed relationship with peers, depression and anxiety. Alcohol and tobacco use were assessed on the last two occasions and impulsivity on the final survey occasion.

The student data was linked across time using a unique identification code adapted from the SHAHRP [10]. This required students to provide three crucial pieces of information: the first letter of their mother's name, the numerical day of their birth, and the last letter of their first name. This unique identification code was also used in the RCTs trial evaluating the CLIMATE Schools: Alcohol Module [11] and CLIMATE Schools: Alcohol and Cannabis Module [12]. In this latter trial, to eliminate the possibility of overlapping codes, all data was coded with a school identifier at the time of collection. Despite this additional school information, there remained a small number of overlapping codes. Hence, in the current trial, to further differentiate between students two further pieces of identifying information were sought: number of older siblings (not including half- or step-siblings) and country of birth.

Demographics

Demographic data included the respondents' gender, age, average grades and number of days absent from school without parental permission in the previous school year.

Drug Knowledge

A student's knowledge of cannabis and psychostimulants was assessed using two separate questionnaires.

Knowledge about cannabis is a 15-item survey which assesses students' knowledge of cannabis in relation to the drug itself, prevalence of use, physical and mental health, legal consequences and information required to minimise the harm associated with cannabis use. For each of the 15 statements concerning cannabis the students were required to indicate whether the statement was 'true', 'false' or whether they 'don't know'. Each correct answer was given a score of 1, giving the total score for this survey a possible range of 0-15. All knowledge assessed in this survey was covered in the CLIMATE Schools: Psychostimulant and Cannabis Use Module. Some of these items were derived from the Cannabis Quiz [263].

Knowledge about psychostimulants is a 15-item survey which assesses students' knowledge of psychostimulants in relation to the drug itself, prevalence of use, physical and mental health, legal consequences and information required to minimise the harm associated with psychostimulant use. For each of the 15 statements concerning psychostimulants, the students were required to indicate whether the statement was 'true', 'false' or whether they 'don't know'. Each correct answer was given a score of 1, giving the total score for this survey a possible range of 0-15. This questionnaire was specifically developed for this project and designed to assess the content covered in the CLIMATE Schools: Psychostimulant and Cannabis Use Module.

Drug Use Questionnaires

The drug use questionnaires assessing cannabis and psychostimulant use were based on the questions from the NDSHS 2004 [278]. This was done to allow for comparison between the use in the current sample and a large scale representative group of Australians.

The Cannabis Use Questionnaire: addresses the following areas: (1) proportion of friends and acquaintances using cannabis, (2) ever used, (3) age of initiation, and (4) use in past 12 months. Although not included in the NDSHS, the presence or absence of use in the last three months was also assessed. Likewise, a number of questions in this survey were modified to assess the patterns of use in the last three months. Specifically, questions from the NDSHS regarding (1) frequency of use, (2) forms of cannabis used (e.g., leaf, heads, buds), (3) mode of use (e.g., joint / bong), and (4) polydrug use were measured in terms of use in the last three months, rather than 12 months as is the case with the NDSHS. This modification was made to allow the measure to be more sensitive given the time interval between each measurement occasion in the current RCT and also to allow for correspondence with the interval assessed by the Cannabis Problems Questionnaire.

The use of two types of psychostimulants were assessed: methamphetamine/ amphetamine (meth/amphetamine) and ecstasy. The use of these two types of psychostimulants were the only ones to be assessed because they are the ones most readily used by the age group of interest in the current RCT [21, 278]. The use of cocaine was not assessed because usage in this age group is minimal (i.e., 0.8% of 12-19 year olds report using this drug in the last 12 months [278]) and for this reason was not a focus of the intervention program.

The Methamphetamine and *Ecstasy Use Questionnaires:* addressed the following areas: 1) proportion of friends and acquaintances using, (2) ever used, (3) age of initiation, (4) use in last one and 12 months, (5) frequency of use in the last 12 months and (6) presence of polydrug use in the last 12 months. An additional question assessing use in the last three months of ecstasy and methamphetamine was added to allow for direct comparison with the rates of cannabis use. All patterns of use (e.g., frequency and mode) were assessed based on 12- month use which is consistent with the NDSHS. This was done because the prevalence of use in this age group is low and a 12-month, rather than three-month interval would potentially allow sufficient numbers to detect possible intervention effects.

Intention to use drugs in the future

Six questions were used to assess student's intention to use cannabis, meth/ amphetamine and ecstasy in the 'next 12 months' and in the 'future'. Each question required students to rate their intention on a five point likert scale labelled 'very likely', 'likely', 'unsure', 'unlikely' and 'very unlikely'.

Harms associated with cannabis and psychostimulant use

Adolescent Cannabis Problems Questionnaire (CPQ-A) [264] is designed to be an assessment tool or treatment outcome measure. This scale is comprised of 27 items which reflect different harms which may occur as a result of cannabis use. Each item requires a person to indicate a yes / no response indicating whether or not they have experienced each cannabis-related harm in the last three months. Total possible scores on the CPQ-A version range from 0-27, with a higher score indicating a greater number of cannabis-related problems. The CPQ-A has three separate factors pertaining to financial/psychosocial consequences, physical consequences, and acute negative consequences of cannabis use. These three factors are significantly inter-correlated and each has a high level of internal consistency where α=0.88, 0.72 and 0.73 respectively. The CPQ-A also has a high test – retest reliability (r=0.91). In terms of validity, the CPQ-A has been found to be a significant predictor of daily cannabis use and cannabis dependence.

Psychostimulant harms: The psychostimulant harms survey consists of 25 items, each of which reflects a different possible harm which can result from the use of psychostimulants. For each item, students are asked to indicate whether they have experienced the harm in the last

12 months by circling either 'yes' or 'no'. For each item where the student endorsed that they had experienced the harm, they were given a score of 1, giving the total score on the harms questionnaire a possible range of 0-25. This 25-item survey was adapted from the alcohol harms survey from the SHAHRP [10] by substituting psychostimulants for alcohol where appropriate (e.g., have you gotten in trouble with the police or law as a result of using psychostimulants?) and replacing other items with a psychostimulant rather than alcohol-related harm (e.g., have you felt paranoid as a result of using psychostimulants?). Due to the lower expected frequency of psychostimulant as compared to alcohol-related harms, students were only asked to indicate the presence or absence of the harm in the past 12 months, rather than the frequency of times they may have experienced the harm, as is the case in the SHAHRP survey. The SHAHRP Alcohol harms survey has excellent internal consistency (α=0.90) and test / re-test reliability (r=0.89).

Attitudes to cannabis and psychostimulant use

Attitudes to Cannabis and Psychostimulants use were assessed using an adapted version of the Life Skills Training Questionnaire (LSTQ)[265]. Four items were used to assess attitudes to cannabis use, such as the perceived social benefits of using cannabis, with responses made on a five-point likert scale, anchored by 1 ('strongly disagree') to 5 ('strongly agree'). Attitudes to psychostimulants were measured using the same four items with 'psychostimulants' inserted in place of 'cannabis'. The LSTQ attitude scale has acceptable internal consistency (α=0.86).

Relationship with peers

Bandura's Resistance Self Regulatory Efficacy Scale has been used as the scale labelled Relationship with *Peers* in the current study [279]. This scale assesses an adolescent's perceived capability of resisting peer pressure to engage in a number of high-risk activities involving alcohol, drugs, unprotected sex and transgressive behaviour. This scale consists of eight items. For each item, students are required to rate their capacity to resist peer pressure on a seven-point likert scale anchored by 1 ('Not well at all') to 7 ('very well'). The Resistance self-regulatory scale has acceptable reliability (r=0.80) [280].

Children's Depression Inventory

Depression was measured using the Children's Depression Inventory Short version (CDI-S) [281]. The CDI-S is a 10-item scale which was developed as a brief screening instrument to assess the severity of depression in children aged seven to 17 years. The CDI-S takes between five and 10 minutes to complete. Each item is aimed at assessing a single depressive symptom. Within each of these items the child is provided with a choice of three statements, each of which corresponds to a different level of symptom severity: 0 (absence of symptoms), 1 (mild or probable symptom), or 2 (definite symptom). The child is asked to choose the sentence that best describes themselves over the past two weeks. For 50% of the items, the first sentence reflects the greatest severity of symptomatology and for the other

50% this order is reversed. A higher score reflects a greater level of depression. Possible scores on this instrument range from 0 to 20. The CDI-S has good internal consistency (Cronbach's alpha = 0.80) and acceptable test/re-test reliability [281]. Information on the validity of the CDI-S is not provided. However, the validity of the 27-item Children's Depression Inventory (CDI) has been shown to be acceptable as children diagnosed with depression score highly on the CDI and the CDI correlates highly with other measures of depression.

Multidimensional Anxiety Scale for Children

Anxiety was measured using the Multidimensional Anxiety Scale for Children-10 item (MASC-10) [282]. The MASC-10 is a 10-item scale where each item measures a cognitive, emotional or behavioural aspect of anxiety. The MASC-10 takes approximately five minutes to complete. For each item, students are asked to indicate how often the statement is true of them on a four point scale: 0 ('never true about me'), 1 ('rarely true about me'), 2 ('sometimes true about me'), and 3 ('often true about me'). The questionnaire asks children to answer each item in terms of how they have felt recently. A higher score reflects a greater level of anxiety. Possible scores on this instrument range from 0–30.

The MASC-10 has acceptable internal consistency (α=0.64–0.71), test/re-test reliability (r=0.83), convergent validity (r=0.90) and discriminant validity (i.e., kappa = 0.42, specificity was 67%, sensitivity was 75%)[282].

Student evaluation questionnaire

Students were asked to rate 10 statements regarding the quality, acceptability and likeability of the program utilising a seven-point scale with the response options ranging from 'strongly agree' to 'strongly disagree'. Examples of these items include: *"The cartoon story was an enjoyable way of learning PDHPE theory"*, *"The cartoon story was relevant to current or future experiences in my life or the lives of my peers"*, or *"The information on psychostimulants and cannabis and how to stay safe in the cartoon story was easy to learn"*.

Teacher evaluation questionnaire

Teachers were asked to rate the quality of the program on a number of standards by ticking one of five response options: 'very good', 'good', 'average', 'poor' and 'very poor'. The items they were asked to rate reflected four areas: educational quality of the program, ease of access and acceptability of a computer resource, accordance with curriculum content, and perception of how well students received the program and teacher's intentions regarding future use. Teachers were also provided with the option of providing any feedback and suggestions for program improvement.

CONTROL program questionnaire

The CONTROL program was designed to assess the timing and content of the program delivered in the CONTROL Schools.

Implementation and student participation

Measures of implementation and student participation were specifically not collected because this trial was intended to assess effectiveness in a real world setting.

Statistical methods

All analyses and descriptive statistics provided are based on the sample of students who were present at baseline. Students who were not present at baseline are not included in the analyses of intervention effects.

Attrition and differential attrition between groups was examined using a series of analysis of variance for normally distributed data, Chi-square and logistic regression for binomial and categorical data, Mann-Whitney U and Kruskal-Wallis for non-normally distributed data. To assess the effectiveness of the intervention all students with baseline data were included in the analysis irrespective of the number of program lessons they attended.

Intervention effects were examined using HLM for normally distributed outcomes measures (i.e., knowledge, expectancies). Hierarchical generalised linear modelling (HGLM) using a Poisson sampling model was used to model count data. All outcome variables were centred at post test, allowing comparison between groups immediately after the completion of the intervention. All analyses were conducted utilising the software program HLM 6 [266, 283]. As recommended by Lee [267] HLM / HGLM procedures were abandoned in favour of single level analyses when the unconditional hierarchical model revealed that less than 10% of systematic variance existed at the between school level. Specifically, when the variance between schools accounts for less than 10% of total variance, it is considered to be trivial and hence the intervention effects should be analysed at the individual student level. The outcome variables which were analysed at the individual student level included: cannabis knowledge, attitudes, ecstasy ever used, intention to use methamphetamine and ecstasy use in the next 12 months, and psychostimulant-related harms. ANCOVA, logistic regression and hierarchical regression utilising SPSS were utilised for the single level analyses. In the absence of available non-parametric mixed models, Harris [284] recommends that standard ANCOVA and hierarchical regression procedures are robust for skewed and proportional data. For each outcome variable to minimise the effects of loss to follow-up, three separate analyses were conducted to assess if there was a significant difference between the groups from baseline to each follow-up occasion. A Bonferroni adjustment was made to control the type 1 error rate (hence $p<0.0167$ is required for significance). For each analysis the corresponding baseline score was entered as a covariate. Although there is some evidence of converging rates of cannabis use between young males and females [64, 285], considerable evidence suggests that males are more likely to use drugs than females. For this reason, in all analyses directly examining drug use behaviour, gender was also taken into account. Analyses were conducted on data from all students present at baseline (n=1734). Confidence intervals are scaled in dependent variable units.

Results

Descriptive statistics for the CLIMATE and CONTROL group:

Drug-related knowledge

Table 7 provides the descriptive statistics for the drug knowledge outcome measures over the four survey occasions for the Climate and Control group.

Table 7: Mean knowledge scores (95% confidence intervals and sample size) for the CLIMATE and CONTROL groups over the four survey occasions.

		Baseline	Post	Five month Follow-up	10-month Follow-up
Cannabis Knowledge*	**Control**	8.81 (8.63-8.98) (n=826)	9.25 (9.04-9.46) (n=576)	9.14 (8.87-9.41) (n=448)	9.51 (9.24-9.78) (n=403)
	Climate	8.69 (8.52-8.86) (n=902)	10.76 (10.58-10.94) (n=627)	10.42 (10.22-10.62) (n=612)	10.39 (10.17-10.61) (n=570)
Psychostimulants knowledge*	**Control**	8.49 (8.31-8.67) (n=823)	9.08 (8.86-9.30) (n=577)	8.89 (8.60-9.18) (n=449)	9.34 (9.05-9.63) (n=403)
	Climate	8.45 (8.27-8.63) (n=899)	10.46 (10.26-10.66) (n=627)	10.25 (10.03-10.47) (n=613)	10.28 (10.04-10.52) (n=569)

*Knowledge scores can range from 0-15; with a higher score reflecting greater knowledge.

Drug-related Attitudes

Table 8 provides the descriptive statistics for students' attitudes towards cannabis and psychostimulants over the four survey occasions for the Climate and Control group.

Table 8: Mean attitude scores (95% confidence interval and sample size) for the CLIMATE and CONTROL group over time

		Baseline	Post	Five month Follow-up	10 month Follow-up
Cannabis Attitude*	**Control**	8.86 (8.62-9.10) n=826	8.71 (8.46-8.96) n=578	8.61 (8.32-8.90) n=445	8.85 (8.54-9.16) n=403
	Climate	8.13 (7.93-8.33) n=905	8.04 (7.80-8.28) n=626	8.30 (8.05-8.55) n=612	7.95 (7.70-8.20) n=568
Psychostimulants Attitude*	**Control**	9.36 (9.14-9.58) n=824	9.55 (9.30-9.80) n=577	9.34 (9.05-9.63) n=445	9.68 (9.37-9.99) n=403
	Climate	8.93 (8.71-9.15) n=904	8.88 (8.63-9.13) n=626	8.96 (8.71-9.21) n=614	8.74 (8.49-8.99) n=568

*Attitude scores range from 4-20; with a higher score reflecting a more positive attitude towards the use of drugs.

Lifetime drug use

The proportion of students who reported having ever used cannabis, meth/amphetamine or ecstasy in their lifetime, for the CLIMATE and the CONTROL groups, are presented in Table 9.

Table 9: The proportion of students who reported having ever used cannabis, meth/amphetamine or ecstasy in their lifetime for the CLIMATE and CONTROL group over time (95% confidence intervals and sample size).

		Baseline	Post	Five month Follow-up	10 month Follow-up
Proportion ever used cannabis	**Control**	0.15 (0.13-0.17) (n=828)	0.16 (0.13-0.19) (n=580)	0.16 (0.13-0.19) (n=450)	0.20 (0.16-0.24) (n=403)
	Climate	0.09 (0.07-0.11) (n=903)	0.11 (0.09-0.13) (n=627)	0.13 (0.10-0.16) (n=614)	0.12 (0.09-0.15) N=570
Proportion ever used meth/amphetamine	**Control**	0.05 (0.04-0.06) n=827	0.06 (0.04-0.08) n=577	0.07 (0.05-0.09) n =449	0.05 (0.03-0.07) n=403
	Climate	0.04 (0.03-0.05) n=906	0.03 (0.02-0.04) n =627	0.05 (0.03-0.07) n =613	0.04 (0.02-0.06) n=570
Proportion ever used ecstasy	**Control**	0.07 (0.05-0.09) n=827	0.09 (0.07-0.11) n=580	0.09 (0.07-0.12) n=449	0.07 (0.05-0.09) n=403
	Climate	0.05 (0.04-0.07) n=904	0.05 (0.03-0.06) n=627	0.06 (0.04-0.08) n=614	0.06 (0.04-0.08) n=569

Drug use in the last three months

Table 10 provides the proportion of students who reported having used cannabis, meth/amphetamine or ecstasy in the last three months for the CLIMATE and the CONTROL groups.

Table 10: The proportion of students who reported having used cannabis, methamphetamine or ecstasy in the last three months for the CLIMATE and CONTROL groups over time.

		Baseline	Post	Five month Follow-up	10 month Follow-up
Proportion used cannabis in last three months	**Control**	0.11 (0.09-0.13) (n=828)	0.10 (0.08-0.12) (n=579)	0.11 (0.08-0.14) (n=403)	0.13 (0.10-0.16) (n=403)
	Climate	0.05 (0.04-0.06) (n=904)	0.08 (0.06-0.10) (n=628)	0.09 (0.07-0.11) (n=614)	0.07 (0.05-0.09) (n=570)
Proportion used meth/amphetamine in last three months	**Control**	0.03 (0.02-0.04) n=826	0.04 (0.02-0.06) n=577	0.04 (0.02-0.06) n =449	0.04 (0.02-0.06) n =403
	Climate	0.02 (0.01-0.03) n=903	0.02 (0.01-0.03) n =627	0.03 (0.02-0.04) n =614	0.02 (0.01-0.03) N=570
Proportion used ecstasy in last three months	**Control**	0.04 (0.03-0.05) n=827	0.06 (0.04-0.08) n=578	0.05 (0.03-0.07) n=447	0.05 (0.03-0.07) n=403
	Climate	0.02 (0.01-0.03) n=904	0.03 (0.02-0.04) n=628	0.03 (0.02-0.04) n=614	0.03 (0.02-0.04) n=569

Frequency of drug use for baseline sample

Table 11 provides the frequency of use of cannabis (last three months), methamphetamine (last 12 months) and ecstasy (last 12 months) for the CLIMATE and the CONTROL groups on each survey occasion. For clarity of meaning, the anchoring of frequency scores is presented below in **Table 11**.

Table 11: Mean frequency of cannabis, meth/amphetamine and ecstasy use (95% confidence interval and sample size), for the CLIMATE and CONTROL group, over the four survey occasions.

		Baseline	Post	Five month Follow-up	10 month Follow-up
Frequency of cannabis use in last three months*	**Control**	0.24 (0.18-0.30) (n=823)	0.25 (0.17-0.33) (n=579)	0.27 (0.19-0.35) (n=447)	0.29 (0.19-0.39) (n=403)
	Climate	0.12 (0.08-0.16) (n=898)	0.15 (0.09-0.21) (n=626)	0.22 (0.14-0.30) (n=614)	0.16 (0.10-0.22) (n=568)
Frequency of meth/amphetamine use in last 12 months**	**Control**	0.12 (0.04-0.12) (n=824)	0.13 (0.02-0.10) (n=578)	0.09 (0.07-0.15) (n=449)	0.10 (0.07-0.15) (n=403)
	Climate	0.08 (0.04-0.12) (n=904)	0.06 (0.02-0.10) (n=628)	0.11 (0.07-0.15) (n=614)	0.09 (0.05-0.13) (n=569)
Frequency of ecstasy use in last 12 months**	**Control**	0.15 (0.11-0.19) (n=824)	0.18 (0.12-0.24) (n=578)	0.16 (0.10-0.22) (n=447)	0.12 (0.10-0.22) (n=403)
	Climate	0.10 (0.06-0.14) (n=904)	0.10 (0.06-0.14) (n=628)	0.12 (0.08-0.16) (n=614)	0.11 (0.07-0.15) (n=569)

*Frequency was coded as: 0=Have not used in the last 3 months, 1=About once a month, 2=Less than once a week, 3=About once a week, 4=More than once a week (but less than daily), 5=Once a day, 6=More than once per day

**Frequency was coded as: 0=Have not used in the last 12 months, 1=once or twice a year, 2=Every few months, 3=About once a month, 4=Once a week or more, 5=every day

Intention to use drugs in the next 12 months for baseline sample

The likelihood rating of using cannabis, methamphetamine and ecstasy in the next 12 months is presented in Table 12 for the CLIMATE and the CONTROL groups on each survey occasion.

Table 12: Mean (95% confidence interval and sample size) likelihood ratings for using cannabis, methamphetamine or ecstasy in the next 12 months for the CLIMATE and the CONTROL group on each survey occasion.

		Baseline	Post	Five month Follow-up	10 month Follow-up
Intention to use cannabis in the next 12 months*	**Control**	0.82 (0.74-0.90) (n=827)	0.92 (0.80-1.04) (n=579)	0.93 (0.79-1.07) (n=448)	0.95 (0.81-1.09) (n=403)
	Climate	0.56 (0.48-0.64) (n=903)	0.62 (0.54-0.70) N=627	0.72 (0.62-0.82) (n=614)	0.61 (0.51-0.71) (n=570)
Intention to use methamphetamine in the next 12 months*	**Control**	0.41 (0.35-0.47) (n=827)	0.52 (0.44-0.60) (n=577)	0.45 (0.35-.055) (n=447)	0.49 (0.39-0.59) (n=403)
	Climate	0.29 (0.23-0.35) (n=902)	0.34 (0.28-0.40) (n=625)	0.36 (0.28-0.44) (n=614)	0.36 (0.28-0.44) (n=569)
Intention to use ecstasy in the next 12 months*	**Control**	0.50 (0.44-0.56) (n=823)	0.63 (0.53-0.73) (n=577)	0.63 (0.53-0.73) (n=445)	0.62 (0.50-0.74) (n=402)
	Climate	0.39 (0.33-0.45) (n=905)	0.40 (0.32-0.48) (n=625)	0.49 (0.40-0.56) (n=614)	0.46 (0.38-0.54) (n=569)

*Intention was coded as: 0=Very unlikely, 1=Unlikely, 2=Unsure, 3=Likely, 4=Very likely

Drug-related harms

The frequency of harms experienced by the CLIMATE and CONTROL group as a result of cannabis and psychostimulants for the four survey occasions are presented in Table 13

Table 13: Mean number of harms (95% confidence interval and sample size) experienced by the CLIMATE and CONTROL group as a result of cannabis and psychostimulants for the four survey occasions.

		Baseline	Post	Five month Follow-up	10 month Follow-up
Cannabis related harms in past three months*.	**Control**	0.80 (0.58-1.02) (n=826)	0.91 (0.64-1.18) (n=579)	0.73 (0.46-1.00) (n=449)	0.69 (0.42-0.96) (n=403)
	Climate	0.36 (0.22-0.50) (n=905)	0.44 (0.24-0.64) (n=627)	0.66 (0.42-0.90) (n=614)	0.41 (0.21-0.61) (n=570)
Psychostimulant related harms in past 12 months.**	**Control**	0.76 (0.54-0.98) (n=825)	0.88 (0.61-1.15) (n=579)	0.74 (0.47-1.01) (n=447)	0.65 (0.40-0.90) (n=403)
	Climate	0.51 (0.33-0.69) (n=903)	0.45 (0.25-0.65) (n=628)	0.65 (0.41-0.89) (n=614)	0.49 (0.25-0.73) (n=569)

*The possible range of scores for cannabis related harms is 0-27

**The possible range of scores for psychostimulant related harms is 0-25

Baseline equivalence

At baseline, the students in the CLIMATE and CONTROL groups differed on a number of outcome variables. Where differences did exist they were consistently in the direction of the CONTROL being a higher-risk group at baseline in comparison with the CLIMATE group. The significant differences between groups are shaded in Table 14.

Table 14: Differences at baseline between the CLIMATE and CONTROL groups

Outcome variable	CONTROL	CLIMATE	Statistical significance
Cannabis Knowledge	8.81	8.69	F(1,1727)=0.91, p=0.34
Psychostimulant Knowledge	8.49	8.45	F(1,1721)=0.13, p=0.72
Cannabis Attitudes	8.86	8.13	F(1,1730)=22.45, p<0.001
Psychostimulant Attitudes	9.36	8.93	F(1,1727)=8.20, p=0.004
Lifetime cannabis use	0.15	0.09	χ2(1)=18.47, p<0.001
Lifetime Methamphetamine use	0.05	0.04	χ2(1)=2.45, p=0.14
Lifetime ecstasy use	0.07	0.05	χ2(1)=1.91, p=0.19
Cannabis use last three months	0.11	0.05	χ2(1)=23.02, p<0.001
Meth/amphetamine last three months	0.03	0.02	χ2(1)=1.90, p=0.17
Ecstasy use last three months	0.04	0.02	χ2(1)=5.88, p=0.02
Cannabis frequency of use (three months)	0.24	0.12	F(1, 1720)=9.57, p=0.002
Meth/amphetamine frequency of use (12 months)	0.12	0.08	F(1,1727)=1.68, p=0.20
Ecstasy frequency of use (last 12 months)	0.15	0.10	F(1,1727)=3.24, p=0.07
Cannabis intention 12 months	0.82	0.56	F(1,1729)=21.77, p<0.0001
Meth/amphetamine intention 12 months	0.41	0.29	F(1, 1728)=9.48, p=0.002
Ecstasy intention 12 months	0.50	0.39	F(1,1727)=5.77, p=0.02
Cannabis harms	0.80	0.36	Mann-Whitney U, z=-4.03, p<0.001
Psychostimulant harms	0.76	0.51	Mann-Whitney U, z=-1.63, p=0.10

Attrition analysis

Attrition analyses were conducted to assess the comparability of those students who were present at baseline only (SINGLE), to those who were present at baseline and at least one further survey occasion (REPEAT) on outcomes measures. Table 15 shows that where significant differences do exist (shaded rows), that they are consistently in the direction of the SINGLE group being a higher risk group.

Table 15: Differences between the SINGLE and REPEAT groups on baseline scores

Outcome variable	SINGLE	REPEAT	Statistical significance
Cannabis Knowledge	8.58	8.78	$F(1,1727)=1.46$ $p=0.23$
Psychostimulant Knowledge	8.26	8.51	$F(1,1721)=2.16$, $p=0.14$
Cannabis Attitudes	9.64	8.24	$F(1,1730)=47.24$, $p<0.0001$
Psychostimulant Attitudes	10.20	8.91	$F(1,1730)=41.57$, $p<0.0001$
Lifetime cannabis use	0.22	0.10	$\chi^2(1)=33.58$, $p<0.0001$
Lifetime Methamphetamine use	0.10	0.03	$\chi^2(1)=27.37$, $p<0.0001$
Lifetime ecstasy use	0.12	0.05	$\chi^2(1)=21.60$, $p<0.0001$
Cannabis use last three months	0.16	0.06	$\chi^2(1)=32.2$, $p<0.0001$
Meth/amphetamine last three months	0.05	0.02	$\chi^2(1)=9.63$, $p=0.004$
Ecstasy use last three months	0.07	0.02	$\chi^2(1)=16.15$, $p<0.001$
Cannabis frequency of use (three months)	0.47	0.12	$F(1,1720)=48.25$, $p<0.001$
Meth/amphetamine frequency of use (12 months)	0.22	0.07	$F(1,1727)=17.61$, $p<0.001$
Ecstasy frequency of use (last 12 months)	0.29	0.09	$F(1, 1727)=29.8$, $p<0.001$
Cannabis intention 12 months	1.10	0.60	$F(1,1729)=44.61$, $p<0.001$
Meth/amphetamine intention 12 months	0.62	0.30	$F(1,1728)=38.20$, $p<0.001$
Ecstasy intention 12 months	0.71	0.38	$F(1,1727)=29.66$, $p<0.001$
Cannabis harms	1.40	0.40	Mann-Whitney U, $z=-5.00$, $p<0.001$
Psychostimulant harms	1.57	0.43	Mann-Whitney U, $z=-4.96$, $p<0.001$

Differential attrition

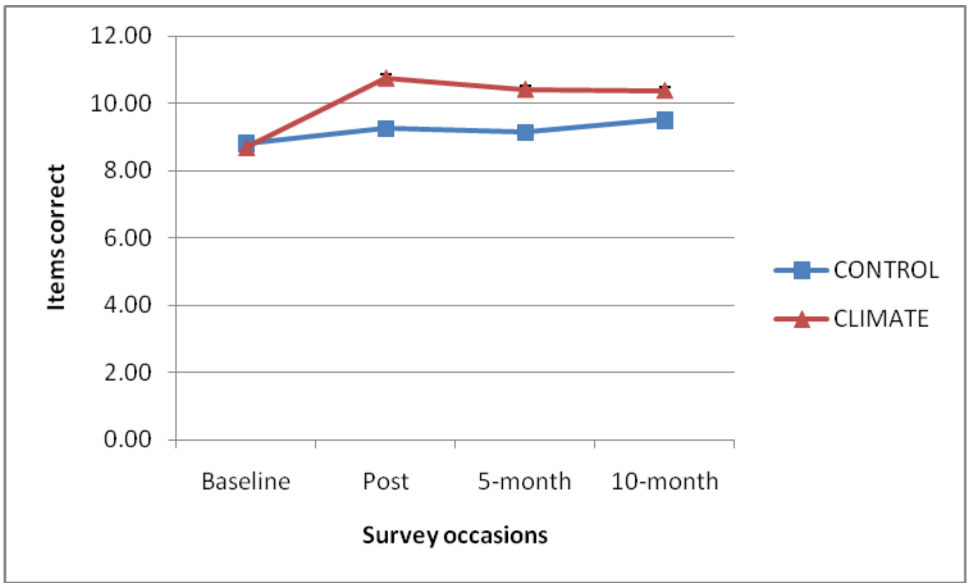
Differential attrition analyses were conducted to assess if there were any differences between the CLIMATE and CONTROL condition in the students who were retained beyond baseline (REPEAT) and those that were lost to follow-up (SINGLE). On all outcome variables, there was no evidence of differential attrition. Specifically, there was no difference between the CLIMATE and CONTROL groups in the students who were included in follow-up surveys and those that were only present at baseline on measures of cannabis related knowledge ($F(3,1727)=0.83$, $p=0.36$), psychostimulant-related knowledge ($F(3,1721)=1.39$, $p=0.24$), attitudes to cannabis use ($F(3,1730)= 0.242$, $p=0.623$), attitudes to psychostimulant use ($F(3,1727)=0.005$, $p=0.942$), lifetime cannabis use (OR: 1.12, 95% CI: 0.57-2.16), lifetime meth/amphetamine use (OR: 0.76, 95% CI: 0.29-1.98), lifetime ecstasy use (OR: 1.41, 95% CI: 0.60-3.32), last three month cannabis use (OR: 1.16, 95% CI: 0.51-2.64), last three month meth/amphetamine use (OR: 1.22, 95% CI: 0.33-4.48), last three month ecstasy use (OR: 1.84, 95% CI: 0.57-5.98), frequency of cannabis use in the last three months ($t(1717)=1.25$; $p=0.21$), frequency of methamphetamine use in the last 12 months ($t(1724)=0.61$, $p=0.55$), frequency of ecstasy use in the last 12 months ($t(1724)=0.12$, $p=0.91$), intention to use cannabis in the next 12 months ($t(1726)=1.57$, $p=0.12$), intention to use methamphetamine in the next 12 months ($t(1725)=0.56$, $p=0.58$), intention to use ecstasy in the next 12 months ($t(1724)=-0.26$, $p=0.79$), cannabis-related problems in the past three months ($t(1727)=0.59$, $p=0.56$) and the number of psychostimulant-related harms experienced in the past 12 months ($t(1724)=1.11$, $p=0.27$).

Intervention effects

Cannabis-related knowledge

The cannabis knowledge scores over time for the CLIMATE and CONTROL group are shown in Figure 12.

Figure 12: Total knowledge scores over time for the CLIMATE and CONTROL group



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	8.69 (0.09)	10.76 (0.09)	10.42 (0.10)	10.39 (0.11)
CONTROL	8.81 (0.09)	9.24 (0.11)	9.14 (0.14)	9.51 (0.14)

Standard HLM procedures were utilised to analyse change in knowledge scores over time.

<u>HLM:</u> The unconditional linear model revealed that less than 10% of the variance (ICC=0.07) could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was not considered appropriate to proceed with HLM procedures. Hence, data were analysed using single level analyses.

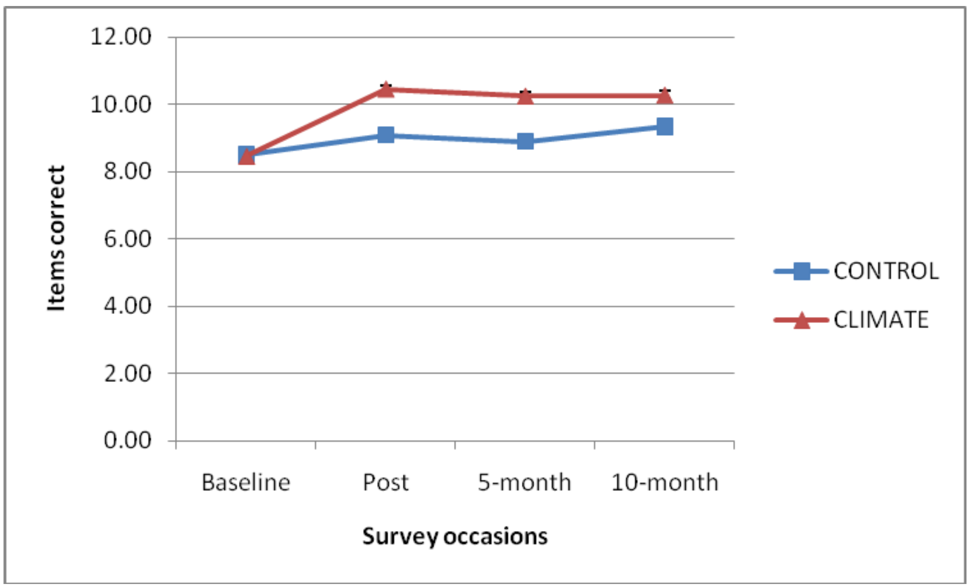
<u>Analysis of covariance:</u> Baseline knowledge scores were entered as a covariate in each of the three analyses. Immediately post intervention there was a significant difference between the CLIMATE and the CONTROL groups ($F(2,1196)=178.74$, $p<0.001$). Students in the CLIMATE group had significantly higher levels of cannabis-related knowledge than those in

the CONTROL group. At five-months post intervention, the CLIMATE group continued to have significantly higher levels of knowledge than the CONTROL group ($F(2,1054)=73.31$, $p<0.001$). This significant difference was also evident 10 months post the intervention ($F(2,970)=34.01$, $p<0.001$).

Psychostimulant-related knowledge

Average psychostimulant knowledge scores for each survey occasion for the CLIMATE and CONTROL group are shown in Figure 13.

Figure 13: Average psychostimulant knowledge scores for each survey occasion for the CLIMATE and CONTROL groups.



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	8.45 (0.09)	10.46 (0.10)	10.25 (0.11)	10.28 (0.12)
CONTROL	8.49 (0.09)	9.08 (0.11)	8.89 (0.15)	9.34 (0.15)

Standard HLM procedures were utilised to analyse change in knowledge scores over time.

<u>HLM:</u> The unconditional linear model revealed that 12.5% of the variance could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HLM procedures.

Unconditional models: The following unconditional model utilised a linear growth term to characterise the pattern of change in knowledge over time. Time was centred to allow the intercept to reflect knowledge post intervention. The unconditional linear model indicated that at immediate post-test, the population psychostimulant knowledge score was 9.20 ($t=62.42$, $p<0.001$) and that knowledge was increasing by 0.48 items per follow-up occasion ($t=7.42$, $p<0.001$). There was significant variation in the mean knowledge scores both within ($\chi^2(1410)=5841.57$, $p<0.001$) and between ($\chi^2(19)=109.06$, $p<0.001$) schools. The variation between schools accounted for 9% of total explainable variance. In terms of linear growth in knowledge, there was significant variation between ($\chi^2(19)=104.70$, $p<0.001$) and within ($\chi^2(1410)=1761.20$, $p<0.001$) schools. Variation between schools accounted for 31.6% of the explainable variance (i.e., total between and within school variation). The deviance for this model is 22710.11 with nine degrees of freedom (see Table 16).

The second unconditional model utilised a linear and quadratic growth term to characterise the pattern of change in knowledge over time. The fit of this model was significantly superior to the fit of the model which only characterised change in growth as having a linear trend ($\chi^2(5)=415.37$, $p<0.0001$) (see Table 16). In this model the population average knowledge score at post-test was 9.56. The average linear growth rate in knowledge at post test was 0.74 items. However, the significant quadratic growth term reveals that the rate of growth in knowledge scores is slowing by a factor of 0.31 units per survey occasion. Variation between schools accounted for 14% of the explainable variance in post-test scores, 31% of the explainable variation in linear growth and 58% of the variation in quadratic growth.

Conditional Model:

School level effects: Intervention effects were explored in Model 4. According to this model, the population mean knowledge score at post-test is 8.82, and there was a significant effect of group, with students in the CLIMATE group scoring 1.33 items higher than students in the CONTROL group. There is significant average population growth in knowledge of 0.30 items per survey occasion. There is also a significant group effect, indicating that for students in the CLIMATE group, their knowledge score increased by an extra 0.78 items per survey occasion compared with the CONTROL group. However, growth in scores is also slowing down by 0.47 items per occasion for the CLIMATE group only. This suggests that although there was a significant difference between groups, this difference is diminishing with time.

In comparison to the unconditional model, it is clear that intervention effects do account for a significant portion of the explainable variance. Specifically, the inclusion of intervention effects explains 59% of the variance in post-test knowledge scores and 68% and 71% of the variance in linear and quadratic growth respectively. This model is clearly superior to the unconditional model with a significant improvement in the model fit ($\chi^2(3)=21.12$, $p<0.0001$) (Table 16).

Table 16: Comparison of deviance statistics across alternative models for knowledge

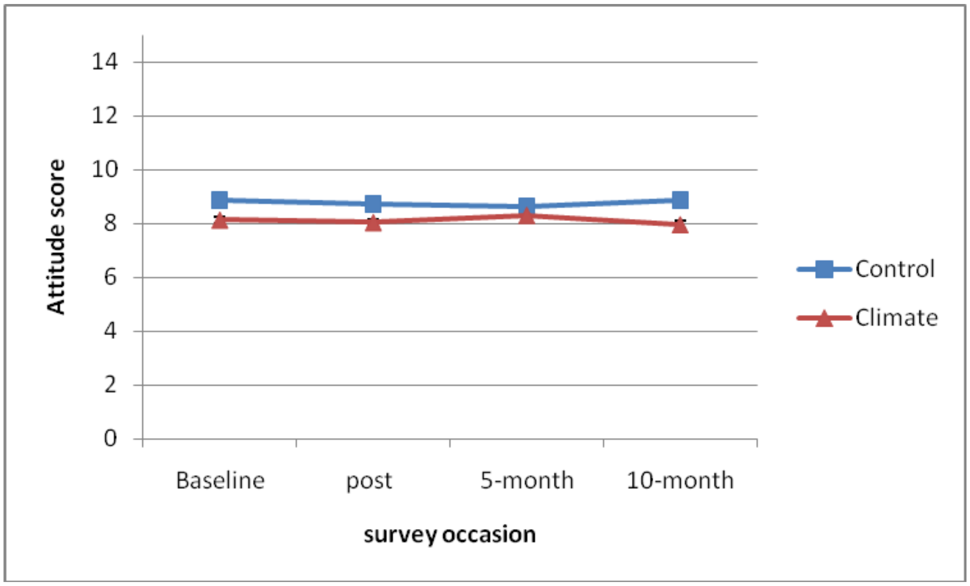
Model Development Summary		Deviance	df
1	Unconditional Model	23125.48	4
2	Unconditional - linear growth in knowledge scores over time.	22710.11	9
3	Unconditional - quadratic growth in knowledge over time.	22493.14	16
4	Conditional – quadratic growth- group entered at level 3.	22472.02	19

Selected Model Comparisons	Difference in deviances	df	P
Model 1 versus Model 2	415.37	5	P<0.0001
Model 3 versus Model 2	216.97	7	P<0.0001
Model 4 versus Model 3	21.12	3	P<0.0001

Attitude to cannabis

The Cannabis attitude scores over time for the CLIMATE and CONTROL groups are shown in Figure 14. A higher score indicates a more positive attitude towards cannabis use.

Figure 14: Total cannabis attitude scores over time for the CLIMATE and CONTROL group



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	8.13 (0.10)	8.04 (0.12)	8.30 (0.13)	7.96 (0.13)
CONTROL	8.86 (0.12)	8.71 (0.13)	8.61 (0.16)	8.85 (0.16)

Standard HLM procedures were utilised to analyse change in cannabis attitude scores over time.

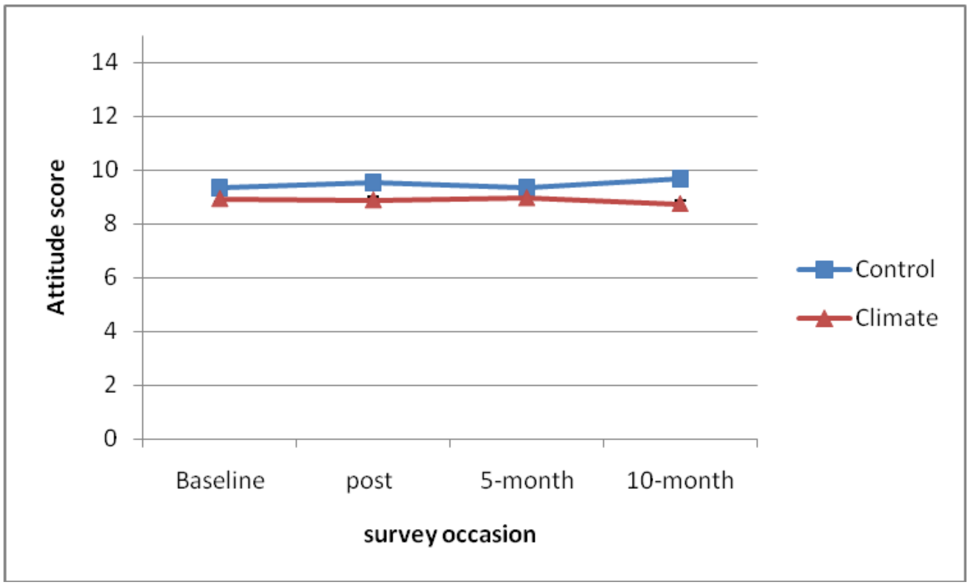
HLM: The unconditional linear model revealed that less than 10% of the variance (ICC=0.098) could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was not considered appropriate to proceed with HLM procedures. Hence, data were analysed using single level analyses.

Analysis of covariance: Baseline cannabis attitude scores were entered as a covariate in each of the three analyses. Immediately post intervention there was no significant difference between the CLIMATE and the CONTROL group ($F(2,1202)=23.93$, $p=0.047$) in cannabis related attitudes. At five-months post intervention, the CLIMATE and CONTROL groups still did not differ significantly in their attitudes towards cannabis use ($F(2,1056)=1.46$, $p=0.637$). By 10 months post intervention, however, the CLIMATE group had significantly lower pro-cannabis attitudes than the CONTROL group ($F(2,970)=7.16$, $p=0.008$).

Attitude to psychostimulants

The psychostimulant attitude scores over time for the CLIMATE and CONTROL groups are shown in Figure 15. A higher score indicates a more positive attitude towards psychostimulant use.

Figure 15: Total psychostimulant attitude scores over time for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	8.93 (0.11)	8.88 (0.13)	8.96 (0.13)	8.74 (0.13)
CONTROL	9.36 (0.11)	9.54 (0.13)	9.34 (0.15)	9.68 (0.16)

Standard HLM procedures were utilised to analyse change in psychostimulant attitude scores over time.

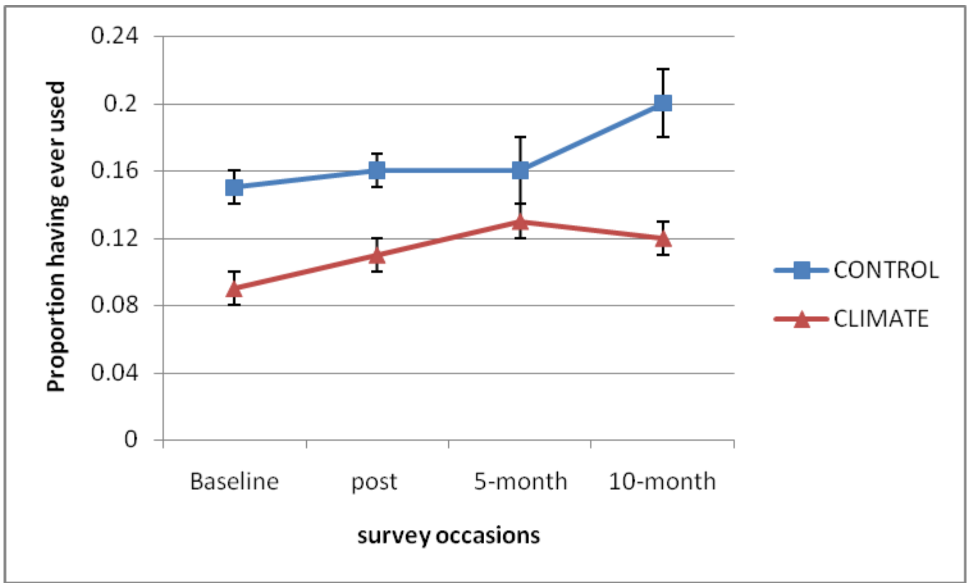
Hierarchical Linear Modelling: The unconditional linear model revealed that less than 10% of the variance (ICC=0.062) could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was not considered appropriate to proceed with hierarchical linear modelling procedures. Hence, data were analysed using single level analyses.

Analysis of covariance: Baseline psychostimulant attitude scores were entered as a covariate in each of the three analyses. Immediately post intervention there was a significant difference between the CLIMATE and the CONTROL group ($F(2,1200)=6.98$, $p=0.008$). Students in the CONTROL group had significantly higher pro psychostimulant use attitudes than the students in the CLIMATE group; even after adjusting for baseline differences. This difference was no longer significant at 5-months post intervention ($F(2,1057)=4.05$, $p=0.045$). By 10-months post intervention the CLIMATE group, once again had significantly lower pro psychostimulant attitudes than the CONTROL group ($F(2,967)=15.02$, $p<0.001$).

Ever used cannabis

The proportion of students who reported having ever used cannabis in their lifetime for the four survey occasions for the CLIMATE and CONTROL group are shown in Figure 16.

Figure 16: The proportion having ever used cannabis over time for the CLIMATE and CONTROL group



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.09 (0.01)	0.11 (0.01)	0.13 (0.01)	0.12 (0.01)
CONTROL	0.15 (0.01)	0.16 (0.01)	0.16 (0.02)	0.20 (0.02)

The variable 'Have you ever used cannabis?' is a binary outcome; hence, a binomial sampling model and logit link function were incorporated at level 1 of the three-level model to analyse change in the proportion having ever used cannabis in their lifetime over the four survey occasions.

Hierarchical generalised linear modelling (HGLM): The unconditional linear model revealed that 18.70% of the variance could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures.

Unconditional models: The following unconditional model utilised a linear growth term to characterise the proportion of young people reporting ever having used cannabis over time. Time was centred to allow the intercept to reflect the proportion having ever used cannabis at post intervention. The unconditional linear model indicates that the probability of having used cannabis at post test is 0.17 (β=-1.60, t=-8.38, p<0.001), with the odds increasing by 1.18 per measurement occasion (OR=1.18, 95% CI: 1.09-1.28). There was significant variation between schools in the odds of having used cannabis at post test ($\chi^2(19)=124.78$, $p<0.001$). There was no significant variation within ($\chi^2(1416)=362.78$, $p>0.5$) or between ($\chi^2(19)=19.93$, $p=0.39$) schools in the linear growth over time, hence linear growth was treated as a fixed effect in future models.

In the third unconditional model, quadratic growth was added to the model as a random coefficient. Quadratic growth was not a significant predictor of the proportion having ever used in cannabis over the survey occasions (OR=0.98, 95% CI: 0.91-1.06). Hence, it was removed from all further models.

Conditional Models:
Individual effects
Gender was added as an individual level predictor in Model 4. Gender was a significant predictor of the proportion of students who reported having ever used cannabis at post-test (OR=0.52, 95% CI: 0.32-0.85), with females being significantly less likely to report having ever used. Gender was not a significant predictor of the linear growth in the odds of having used cannabis over time (OR=1.00, 95% CI: 0.84-1.18).

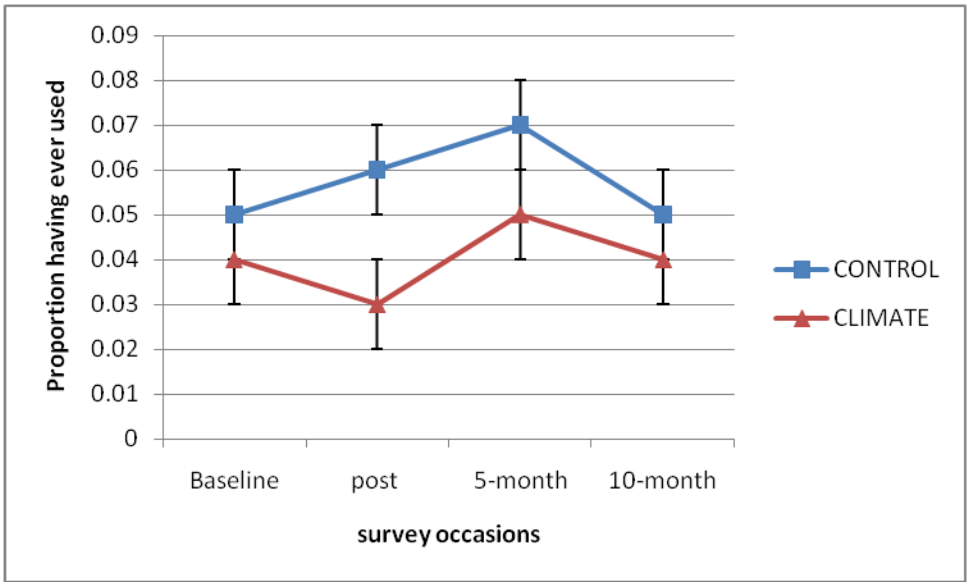
School level effects

Intervention effects were explored in Model 5. Intervention was not found to be a significant predictor of post test scores (OR=0.67, 95% CI: 0.31-1.44) or linear growth over time (OR=1.05, 95% CI: 0.92-1.20).

Ever used meth/amphetamine

The proportion of students who reported having ever used methamphetamine in their lifetime for the four survey occasions for the CLIMATE and CONTROL groups are shown in Figure 17.

Figure 17: The proportion having ever used meth/amphetamine over time for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.04 (0.01)	0.03 (0.01)	0.05 (0.01)	0.04 (0.01)
CONTROL	0.05 (0.01)	0.06 (0.01)	0.07 (0.01)	0.05 (0.01)

The variable 'Have you ever used methamphetamine / amphetamine for non-medical purposes?' is a binary outcome; hence, a binomial sampling model and logit link function were incorporated at level 1 of the three-levels model to analyse change in the proportion having ever used meth/amphetamine in their lifetime over the four survey occasions.

HGLM: The unconditional linear model revealed that 16.54% of the variance could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures.

Unconditional models: The following unconditional model utilised a linear growth term to characterize the proportion of young people reporting having used meth/amphetamine over time. Time was centred to allow the intercept to reflect the proportion having ever used meth/amphetamine at post intervention. The unconditional linear model indicates that the probability of having used meth/amphetamine at post test is 0.08 (β=-2.47, t=-15.40, p<0.001), with the odds increasing by 1.11 per measurement occasion (OR=1.11, 95% CI: 1.02-1.21). There was significant variation between schools in the odds of having used meth/amphetamine at post test ($\chi^2(19)=71.10$, p<0.001). There was no significant variation within ($\chi^2(1416)=279.17$, p>0.5) or between ($\chi^2(19)=14.97$, p>0.5) schools in the linear growth over time, hence linear growth was treated as a fixed effect in future models.

In the third unconditional model, quadratic growth was added to the model as a random coefficient. Quadratic growth was not a significant predictor of the proportion having ever used in meth/amphetamine over the survey occasions (OR=0.96, 95% CI: 0.89-1.05). Hence, it was removed from all further models.

Conditional Models:

Individual effects

Gender was added as an individual level predictor in Model 4. Gender was a significant predictor of the proportion of students who reported having ever used meth/amphetamine at post-test (OR=0.65, 95% CI: 0.42-0.99), with girls being significantly less likely to report having ever used. Gender was not a significant predictor of the linear growth in the odds of having used methamphetamine over time (OR=1.05, 95% CI: 0.86-1.28).

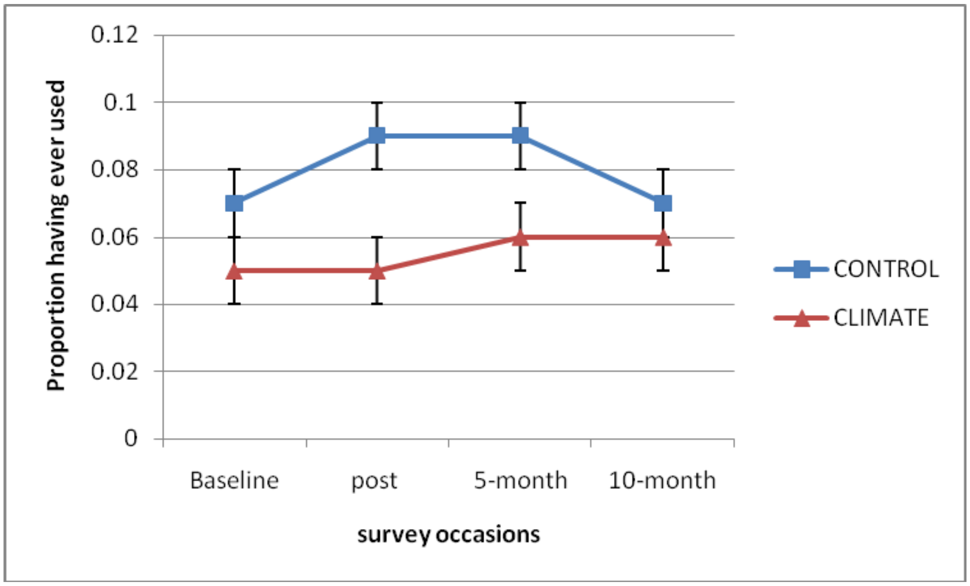
School level effects

Intervention effects were explored in Model 5. Intervention was not found to be a significant predictor of post test scores (OR=0.60, 95% CI: 0.29-1.26) or linear growth over time (OR=1.02, 95% CI: 0.85-1.22).

Ever used ecstasy

The proportion of students who reported having ever used ecstasy in their lifetime for the four survey occasions for the CLIMATE and CONTROL groups are shown in Figure 18.

Figure 18: The proportion having ever used ecstasy over time for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.05 (0.01)	0.05 (0.01)	0.06 (0.01)	0.06 (0.01)
CONTROL	0.07 (0.01)	0.09 (0.01)	0.09 (0.01)	0.07 (0.01)

The variable 'Have you ever used ecstasy?' is a binary outcome, hence, a binomial sampling model and logit link function were incorporated at level 1 of the three-levels model to analyse change in the proportion having ever used ecstasy in their lifetime over the four survey occasions.

<u>HGLM:</u> The unconditional linear model revealed that less than 10% of the variance (ICC=0.09) could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was not considered appropriate to proceed with HGLM procedures. Hence, data were analysed using single level analyses.

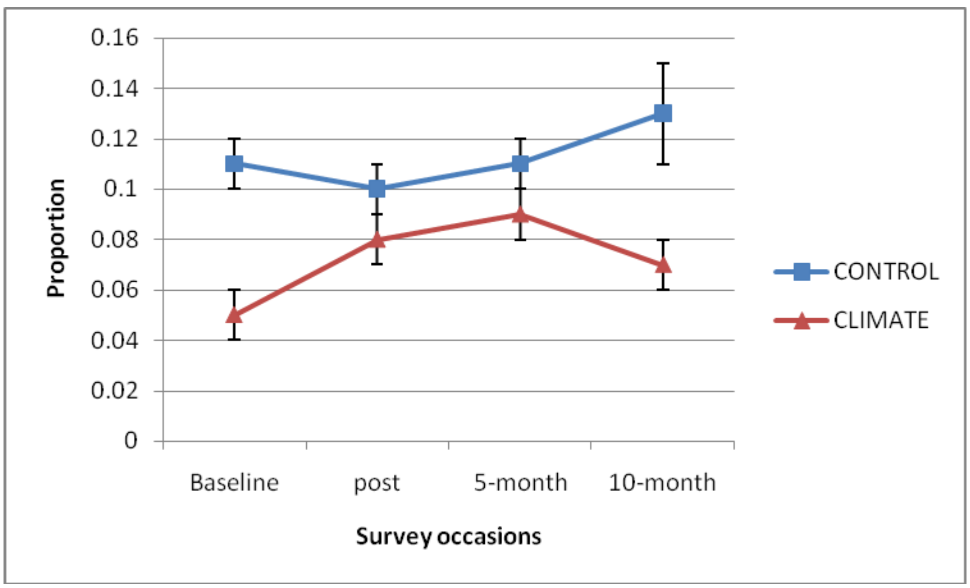
<u>Logistic regression:</u> Lifetime ecstasy use at baseline and gender was entered as a covariate in the model. At post test, gender was not a significant predictor of lifetime ecstasy use (OR: 1.56, 95% CI: 0.83-2.92), but intervention condition was a significant predictor. The results

revealed that students in the CONTROL group were twice as likely to have ever used ecstasy in their lifetime compared with students in the CLIMATE group (OR: 2.27 95% CI: 1.20-4.27). At neither the five-month (OR: 1.30 95% CI: 0.74-2.28) nor 10- month (OR: 1.83 95% CI: 0.97-3.43) follow up was gender a significant predictor of having ever used ecstasy. At both the five-month (OR: 1.56 95% CI: 0.91-2.68) and 10-month (OR: 1.00 95% CI: 0.55-1.81) follow-up occasion, intervention condition was also not a significant predictor of having ever used ecstasy after taking baseline and gender into account.

Cannabis Use last three months

The proportion of students reporting cannabis use in the last three months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 19.

Figure 19: The proportion of students reporting cannabis use for the CLIMATE and CONTROL group over time



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.05 (0.01)	0.08 (0.01)	0.09 (0.01)	0.07 (0.01)
CONTROL	0.11 (0.01)	0.10 (0.01)	0.11 (0.01)	0.13 (0.02)

The variable 'Have you used cannabis in the last three months?' is a binary outcome; hence, a binomial sampling model and logit link function were incorporated at level 1 of the three-levels model to analyse change in the proportion having used cannabis in the last three months over the four survey occasions.

HGLM: The unconditional linear model revealed that 25.3% of the variance could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures.

Unconditional models: The following unconditional model utilised a linear growth term to characterize the pattern of in the proportion of young people reporting having used cannabis in the last three months. Time was centred to allow the intercept to reflect the proportion having used in the last three months at post intervention. The unconditional linear model indicates that the probability of having used cannabis in the last three months at post test is 0.08 (β=-2.25, t=-10.73, p<0.001), with the odds increasing by 1.14 per measurement occasion (OR=1.14, 95% CI: 1.04-1.26). There was significant variation between schools in the odds of having used cannabis in the last three months at post test ($\chi^2(19)=289.31$, p<0.001). There was also significant variation within schools in linear growth of last three month cannabis use over time ($\chi^2(1713)=1826.61$, p<0.001). There was no significant variation between schools in the linear growth over time ($\chi^2(19)=17.17$, p >0.5), hence was treated as a fixed effect in future models.

In the third unconditional model, linear growth was treated as a fixed effect and quadratic growth was added to the model as a random coefficient. Quadratic growth was not a significant predictor of the proportion having used in cannabis in the last three months over the survey occasions (OR=0.89, 95% CI: 0.79-1.00). Hence, it was removed from all further models.

Conditional Models:

Individual effects

Gender was added as an individual level predictor in Model 4. Gender was not a significant predictor of the proportion of students who reported having used cannabis in the last three months at post-test (OR=0.62, 95% CI: 0.35-1.09) and nor did gender predict linear growth in the odds of having used cannabis in the last three months over time (OR=1.07, 95% CI: 0.87-1.33).

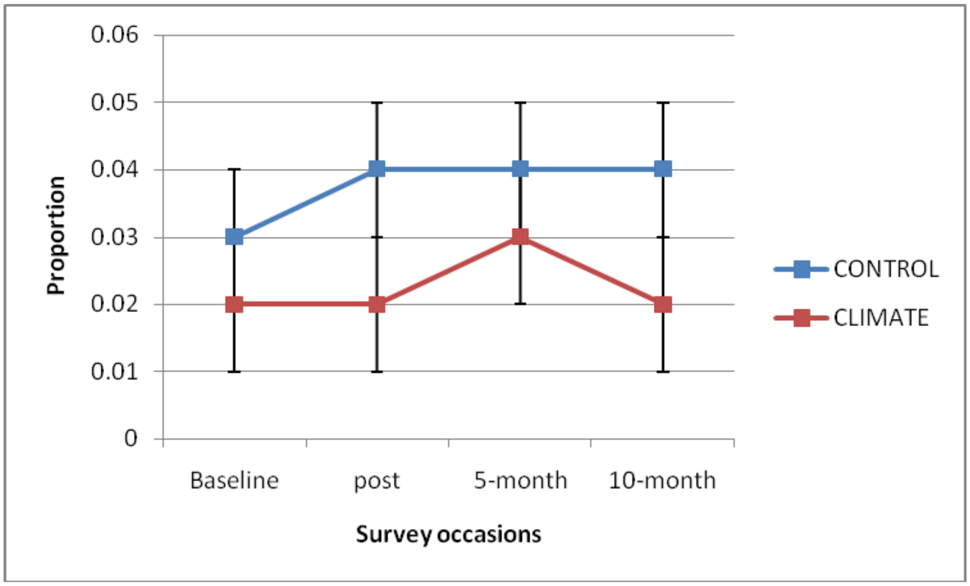
School level effects

Intervention effects were explored in Model 5. Intervention was not found to be a significant predictor of post test scores (OR=0.62, 95% CI: 0.27-1.43) or linear growth over time (OR=1.08, 95% CI: 0.92-1.28).

Meth/amphetamine Use last three months

The proportion of students reporting methamphetamine use in the last three months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 20.

Figure 20: The proportion of students reporting methamphetamine use for the CLIMATE and CONTROL group over time



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.02 (0.01)	0.02 (0.01)	0.03 (0.01)	0.02 (0.01)
CONTROL	0.03 (0.01)	0.04 (0.01)	0.04 (0.01)	0.04 (0.01)

The variable 'Have you used meth/amphetamine in the last three months?' is a binary outcome; hence, a binomial sampling model and logit link function were incorporated at level 1 of the three-levels model to analyse change in the proportion having used meth/amphetamine in the last three months over the four survey occasions.

HGLM: The unconditional linear model revealed that 19.10% of the variance could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures.

Unconditional models: The following unconditional model utilised a linear growth term to characterise the proportion of young people reporting having used meth/amphetamine in the last three months over time. Time was centred to allow the intercept to reflect the proportion having used in the last three months at post intervention. The unconditional linear model indicates that the probability of having used meth/amphetamine in the last three months at post test is 0.05 (β=-2.87, t=-17.35, $p<0.001$), with the odds increasing by 1.14 per measurement occasion (OR=1.14, 95% CI: 1.03-1.26). There was significant variation between schools in the odds of having used meth/amphetamine in the last three months at post test ($\chi^2(19)=59.66$, $p<0.0001$). As there was no significant variation within ($\chi^2(1415)=262.87$, $p>0.5$) or between schools in the linear growth over time ($\chi^2(19)=16.37$, $p>0.5$), linear growth was treated as a fixed effect in future models.

In the third unconditional model, linear growth was treated as a fixed effect and quadratic growth was added to the model as a random coefficient. Quadratic growth was not a significant predictor of the proportion having used in methamphetamine in the last three months over the survey occasions (OR=0.91, 95% CI: 0.82-1.00). Hence, it was removed from all further models.

Conditional Models:
Individual effects
Gender was added as an individual level predictor in Model 4. Gender was a significant predictor of the proportion of students who reported having used methamphetamine in the last three months at post-test (OR=0.57, 95% CI: 0.35-0.97). That is, female students were significantly less likely to have used methamphetamine in the last three months at post-test. Gender did not predict linear growth in the odds of having used cannabis in the last three months over time (OR=0.81, 95% CI: 0.62-1.08). This model also revealed that once gender was added to the model, there was no significant variation remaining at a between or within school level. Hence, intervention effects were not added to the model with gender.

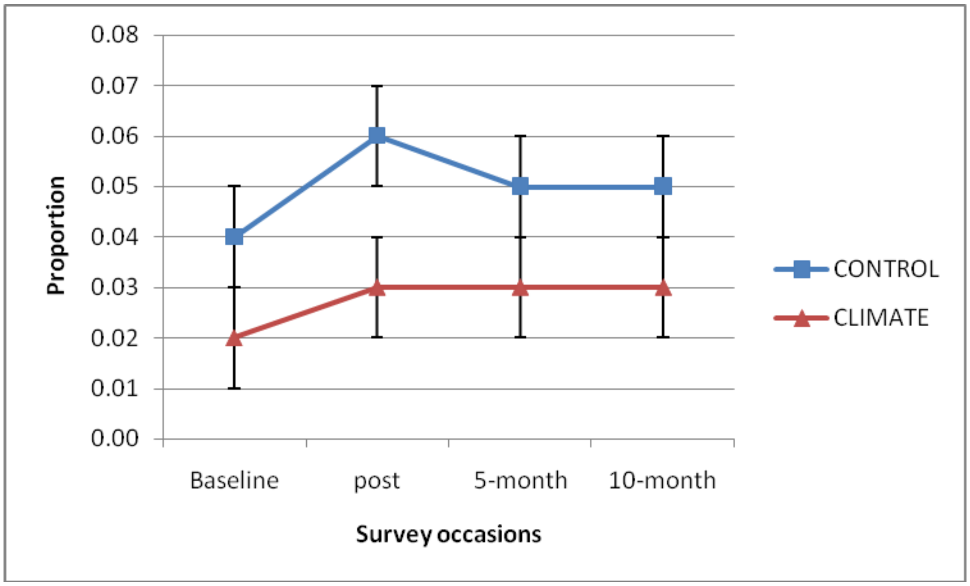
School level effects

Intervention effects were explored independent of taking gender into account Model 5. Intervention was not found to be a significant predictor of post test scores (OR=0.63, 95% CI: 0.33-1.20) or linear growth over time (OR=0.03, 95% CI: 0.84-1.27).

Ecstasy Use last three months

The proportion of students reporting ecstasy use in the last three months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 21.

Figure 21: The proportion of students reporting last three month ecstasy use for the CLIMATE and CONTROL groups over time



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.02 (0.01)	0.03 (0.01)	0.03 (0.01)	0.03 (0.01)
CONTROL	0.04 (0.01)	0.06 (0.01)	0.05 (0.01)	0.05 (0.01)

The variable 'Have you used ecstasy in the last 3 months?' is a binary outcome; hence, a binomial sampling model and logit link function were incorporated at level 1 of the three-levels model to analyse change in the proportion having used ecstasy in the last three months over the four survey occasions.

<u>HGLM:</u> The unconditional linear model revealed that 16.79% of the variance could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures. This unconditional model revealed that the within school variation was not significant ($\chi^2(1713) = 1075.92$, $p>0.5$) and hence was constrained in further models. The between school variation in the proportion having used ecstasy in the last three months was significant ($\chi^2(20) = 74.26$, $p<0.001$).

Unconditional models: The second unconditional model utilised a linear growth term to characterise change in ecstasy use over time. The pattern of change in last three month ecstasy use over time could not be characterised by linear growth (OR=1.11, 95% CI: 0.97-1.29). The third unconditional model utilised a quadratic growth term to characterise change in the proportion of students using ecstasy over time, the quadratic term was significant (OR=1.12, 95% CI: 1.02-1.24). However, there was no significant variation within ($\chi^2(1712) = 1257.48$, $p>0.5$) or between schools ($\chi^2(19) = 11.89$, $p>0.5$) in quadratic growth over time.

Conditional Model:

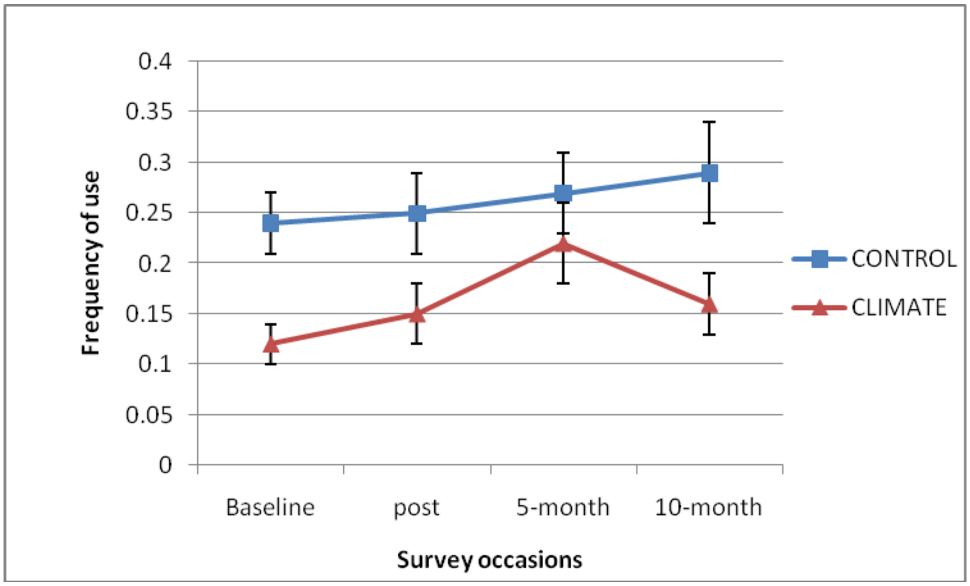
Individual effects
The first conditional model explored the role of gender in last three month ecstasy use. Due to the lack of variation in last three month ecstasy use, within and between schools, gender was only included as a predictor of post-intervention scores and not changing use over time. Gender was a significant predictor of the proportion of students who reported having used ecstasy in the last three months at post-intervention. Specifically, females were less likely to have used ecstasy in the last three months in comparison with males (OR=0.50, 95% CI: 0.32-0.77). After taking gender into account there was still significant variation between schools in post-intervention scores ($\chi^2(20) = 57.32$, $p<0.001$). Hence, intervention effects were added into the final model.

School level effects
Intervention was not a significant predictor of the difference between schools in post-intervention scores (OR=0.64, 95% CI: 0.37-1.11).

Frequency of Cannabis Use last three months – entire baseline sample

The reported frequency of cannabis use in the last three months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 22

Figure 22: Frequency of cannabis use over time for the CLIMATE and CONTROL group



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.12 (0.02)	0.15 (0.03)	0.22 (0.04)	0.16 (0.03)
CONTROL	0.24 (0.03)	0.25 (0.04)	0.27 (0.04)	0.29 (0.05)

HGLM procedures utilising a Poisson distribution was utilised to analyse the frequency of cannabis use in the last three months.

HGLM: The unconditional linear model revealed that 20.57% of the variance could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures. This unconditional model revealed that there was significant variation in the frequency of use both within ($\chi^2(1708) = 2498.26$, $p<0.001$) and between ($\chi^2(20) = 169.50$, $p<0.001$) schools.

Unconditional models: The second unconditional model used a linear growth term to characterise the change in frequency of cannabis use (last three months) over time. Time was centred to allow the intercept to reflect the frequency of cannabis use at post intervention. The unconditional linear model indicated that at immediate post-test, the population frequency of last three month cannabis use was 0.29 (Event rate ratio=0.29, 95% CI: 0.19-0.44), suggesting that the average frequency of cannabis use was less than once per month (where 0: not used in last three months, 1: About once per month). The model revealed that the frequency was increasing linearly at a rate of 1.25 per survey occasion (Event rate ratio=1.25, 95% CI: 1.16-1.35). There was significant variation in last three month frequency of cannabis use both within ($\chi^2(1412)=2176.70$, $p<0.001$) and between ($\chi^2(19)=152.25$, $p<0.001$) schools. The variation between schools accounted for 22% of total explainable variance. In terms of linear growth in the frequency of cannabis use, there was significant variation between ($\chi^2(19)=32.95$, $p=0.02$), but not within schools ($\chi^2(1412)=388.11$, $p>0.5$) schools. Hence, variation within school in linear growth was constrained to zero in all future models.

The third unconditional model utilised a linear and quadratic growth term to characterize the pattern of change in frequency of last three month cannabis use over time. Quadratic growth was a significant predictor of the changing frequency of last three month cannabis use over time (Event rate ratio=0.91, 95% CI: 0.87-0.94). This means that even though the frequency of cannabis use increased linearly by an event rate of 1.33 per occasion, it also declined at a rate of 0.91 per occasion. In terms of quadratic growth, there was no significant variation between ($\chi^2(19)=24.69$, $p=0.17$) or within schools ($\chi^2(1342)=0.05$, $p>0.5$); hence, in all further models this was treated as a fixed factor.

Conditional Models:

Individual effects

Gender was added as a school level predictor in Model 4. Gender significantly predicted post-test scores and quadratic growth in the frequency of cannabis use in the last three months. Specifically, at post-test, the frequency of use for females was significantly lower than for males (Event rate ratio: 0.54, 95% 0.34-0.85), but the quadratic growth was greater for females than males over time (Event rate ratio=1.21, 95% CI: 1.02-1.43). Gender was not a significant predictor of linear growth in the frequency of last three month cannabis use over time (Event rate ratio: 1.12, 95% CI: 0.86-1.45) and hence was removed as a predictor of linear growth over time.

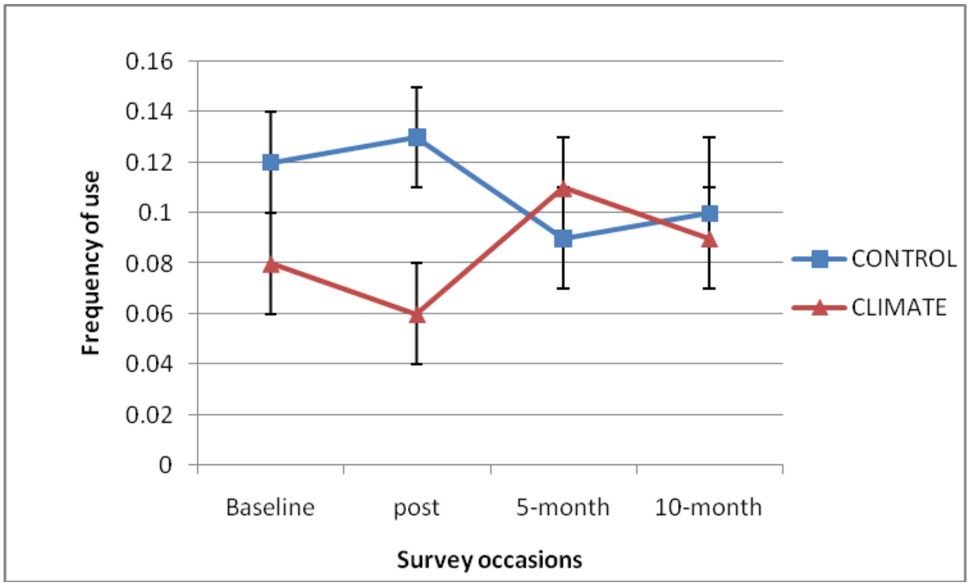
School level effects

Intervention effects were explored in Model 5. According to this model, intervention was not a significant predictor of the frequency of last three month cannabis use at post-test (Event rate ratio=0.65, 95% CI: 0.29-1.47) or linear (Event rate ratio=1.15, 95% CI: 0.97-1.39) and quadratic (Event rate ratio=1.03, 95% CI: 0.93-1.13) growth over time. Intervention did, however, interact with gender in predicting quadratic growth over time. Specifically, in females in the CLIMATE group had a significantly greater decline in quadratic growth of cannabis use over time (Even rate ratio: 0.60, 95% CI: 0.51-0.71).

Frequency of meth/amphetamine in the last 12 months

The frequency of methamphetamine use in the last 12 months over the different survey occasions for the CLIMATE and CONTROL groups is displayed in Figure 23.

Figure 23: Frequency of methamphetamine use for students in the CLIMATE and CONTROL groups over time



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.08 (0.02)	0.06 (0.02)	0.11 (0.02)	0.09 (0.02)
CONTROL	0.12 (0.02)	0.13 (0.02)	0.09 (0.02)	0.10 (0.03)

HGLM procedures utilising a Poisson distribution were utilised to analyse the frequency of meth/amphetamine use in the last 12 months.

HGLM: The unconditional linear model revealed that 11.54% of the variance could be accounted for at the between-school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures. This unconditional model revealed that there was significant variation in the frequency of use both within ($\chi^2(1711) = 2362.61$, $p<0.001$) and between ($\chi^2(20) = 77.00$, $p<0.001$) schools.

Unconditional models: The second unconditional model used a linear growth term to characterise the change frequency of methamphetamine use (last 12 months) over time. Time was centred to allow the intercept to reflect the frequency of methamphetamine use at post intervention. The unconditional linear model indicated that at immediate post-test, the population frequency of last 12 month methamphetamine use was 0.14 (Event rate ratio=0.14, 95% CI: 0.10-0.19), suggesting that the average frequency of methamphetamine use was less than once or twice per year. The model revealed that the frequency was increasing linearly at a rate of 1.15 per survey occasion (Event rate ratio=1.15, 95% CI: 1.07-1.25). In terms of linear growth in the frequency of methamphetamine use, there was not significant variation between ($\chi^2(19)=17.05$, $p>0.5$) or within schools ($\chi^2(1414)=265.94$, $p>0.5$) schools. Hence, variation between and within school in linear growth was constrained to zero in all future models.

The third unconditional model utilised a linear and quadratic growth term to characterise the pattern of change in frequency of past 12 month methamphetamine use over time. Quadratic growth was not a significant predictor of the changing frequency of last three month methamphetamine use over time (Event rate ratio=0.94, 95% CI: 0.86-1.03). Hence, the quadratic term was omitted in future models.

Conditional Models:

Individual effects

Gender was added as a school level predictor in Model 4. Gender significantly predicted post-test scores. Specifically, at post-test, the frequency of use for females was significantly lower than for males (Event rate ratio: 0.54, 95% 0.34-0.86). Gender was not a significant predictor of linear growth in the frequency of last 12 month methamphetamine use over time (Event rate ratio: 0.84, 95% CI: 0.67-1.05) and, hence, was removed as a predictor of linear growth over time.

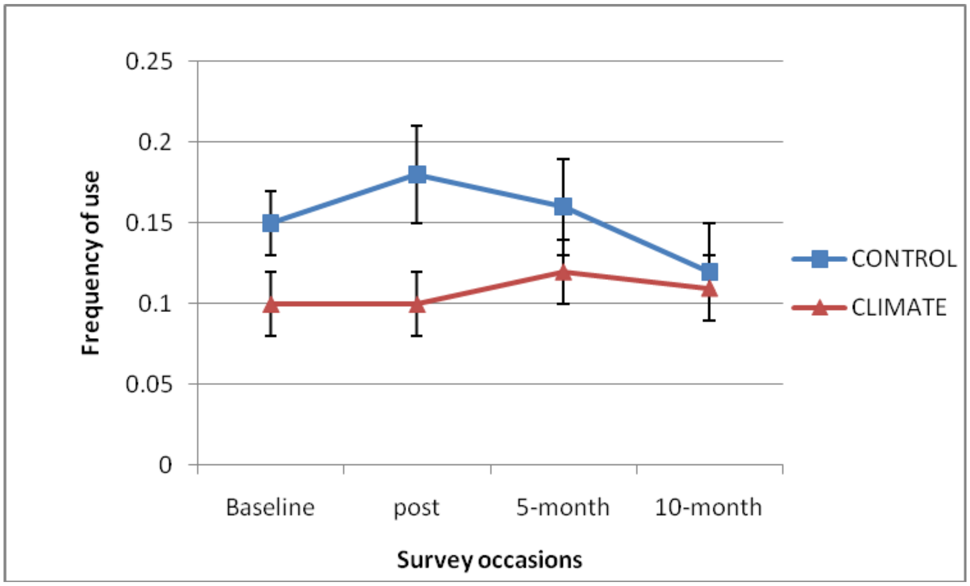
School level effects

Intervention effects were explored in Model 5. According to this model, intervention was not a significant predictor of the frequency of last 12 month methamphetamine use at post-test (Event rate ratio=0.71, 95% CI: 0.37-1.39) or linear growth over time (Event rate ratio=1.17, 95%CI: 0.92-1.49). There was also no evidence of gender by group interaction on post-test scores (Event rate ratio=1.08, 95% CI: 0.43-2.69).

Frequency of Ecstasy Use last 12 months – baseline sample

The reported frequency of ecstasy use for the last 12 months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 24.

Figure 24: Frequency of ecstasy use for the last 12 months over time for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.10 (0.02)	0.10 (0.02)	0.12 (0.02)	0.11 (0.02)
CONTROL	0.15 (0.02)	0.18 (0.03)	0.16 (0.03)	0.12 (0.03)

HGLM procedures utilising a Poisson distribution were utilised to analyse the frequency of ecstasy use in the last 12 months.

HGLM: The unconditional linear model revealed that 10.52% of the variance could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures. This unconditional model revealed that there was significant variation in the frequency of use both within ($\chi^2(1711) = 2912.80$, $p<0.001$) and between ($\chi^2(20) = 79.73$, $p<0.001$) schools.

Unconditional models: The second unconditional model used a linear growth term to characterise the change frequency of ecstasy use (last 12 months) over time. Time was centred to allow the intercept to reflect the frequency of ecstasy use at post intervention. The unconditional linear model indicated that at immediate post-test, the population frequency of last 12 month ecstasy use was 0.18 (Event rate ratio=0.18, 95% CI: 0.13-0.24), suggesting that the average frequency of ecstasy use was less than once or twice per year. The model revealed that the frequency was increasing linearly at a rate of 1.14 per survey occasion (Event rate ratio=1.14, 95% CI: 1.06-1.23). In terms of linear growth in the frequency of ecstasy, there was not significant variation between (χ^2(19)=26.37, p=0.12) or within schools (χ^2(1412)=302.29, p>0.5) schools. Hence, variation between and within school in linear growth was constrained to zero in all future models. These estimates are also based on a model which had not converged, suggesting poor model fit.

The third unconditional model utilised a linear and quadratic growth term to characterise the pattern of change in frequency of last 12 month ecstasy use over time. This model did converge. Linear growth was found to be a significant predictor, with use increasing at a rate of 1.28 per occasion (Event rate ratio=1.28, 95% CI: 1.19-1.38). Quadratic growth was also a significant predictor of the changing frequency of last 12 month ecstasy use over time (Event rate ratio=0.88, 95% CI: 0.82-0.95). This means that even though the frequency of ecstasy use increased linearly by an event rate of 1.28 per occasion, it also declined at a rate of 0.88 per occasion. In terms of quadratic growth, there was no significant variation between (χ^2(19)=26.32, p=0.12) or within schools (χ^2(1344)=288.21, p>0.5); hence, in all further models this was treated as a fixed factor.

Conditional Models:

Individual effects

Gender was added as a school level predictor in Model 4. Gender significantly predicted post-test scores. Specifically, at post-test, the frequency of use for females was significantly lower than for males (Event rate ratio: 0.61, 95% 0.34-0.99). Gender was not a significant predictor of linear (Event rate ratio: 0.97, 95% CI: 0.75-1.26) or quadratic growth (Event rate ratio: 0.91, 95% CI: 0.77-1.07) in the frequency of last 12 month ecstasy use over time and hence was removed as a predictor of linear and quadratic growth over time.

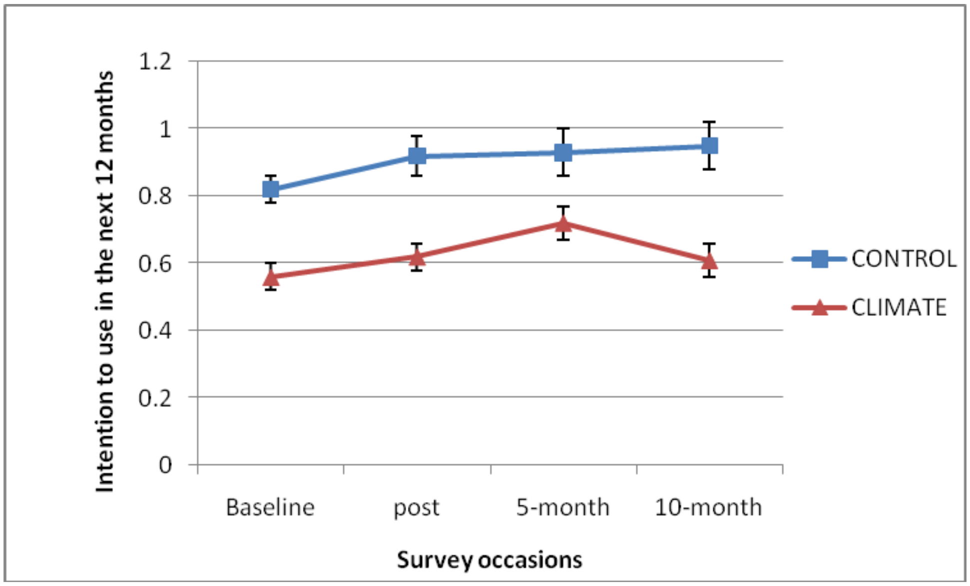
School level effects

Intervention effects were explored in Model 5. According to this model, intervention was a significant predictor of the frequency of last 12 month ecstasy use at post-test (Event rate ratio=0.50, 95% CI: 0.26-0.95). Specifically, the CLIMATE group demonstrated a significantly lower frequency of ecstasy use in comparison with the CONTROL at post-test. By contrast, the CLIMATE group did demonstrate significantly greater quadratic growth in the frequency of ecstasy use over time (Event rate ration=1.17, 95% CI: 1.04-1.31). There was no significant difference between groups in the rate of linear growth in the frequency of ecstasy use over time (Event rate ratio=0.95, 95% CI: 0.82-1.12).

Intention to use cannabis in the next 12 months

The reported intention to use cannabis in the next 12 months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 25.

Figure 25: Intention to use cannabis in the next 12 months for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.56 (0.04)	0.62 (0.04)	0.72 (0.05)	0.61 (0.05)
CONTROL	0.82 (0.04)	0.92 (0.06)	0.93 (0.07)	0.95 (0.07)

HGLM procedures utilising a Poisson distribution was utilised to analyse students' self-reported data on intention to use cannabis in the next 12 months.

<u>HGLM:</u> The unconditional linear model revealed that 10.17% of the variance could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM. This unconditional model revealed that there was significant variation in students intention to use in the next 12 months both within ($\chi^2(1712) = 5395.59$, $p<0.001$) and between ($\chi^2(20) = 148.09$, $p<0.001$) schools.

Unconditional models: The second unconditional model used a linear growth term to characterise the change intention to use cannabis in the next 12 months over the survey occasions. Time was centred to allow the intercept to reflect the intention to use cannabis in the next 12 months at post test. The unconditional linear model indicated that at immediate post-test, the average population intention to use cannabis in the next 12 months was not significantly different to zero (Event rate ratio=0.87, 95% CI: 0.70-1.08), suggesting that the vast majority of young people believed that it was very unlikely that they would use cannabis in the next 12 months. The intention use in the next 12 months increased linearly at a rate of 1.13 per survey occasion (Event rate ratio=1.13, 95% CI: 1.09-1.16). There was significant variation in intention to use cannabis in the next 12 months both within ($\chi^2(1414)=3895.85$, $p<0.001$) and between ($\chi^2(19)=133.41$, $p<0.001$) schools. The variation between schools accounted for 10.4% of total explainable variance. In terms of linear growth in the intention to use cannabis in the next 12 months, there was not significant variation within ($\chi^2(1414)=720.91$, $p>0.5$) or between ($\chi^2(19)=25.60$, $p=0.14$) in linear growth. Hence, variation within and between schools in linear growth was constrained to zero in all future models.

The third unconditional model utilised a linear and quadratic growth term to characterise the pattern of change in the 'intent to use cannabis in the next 12 months' over time. Quadratic growth was a significant predictor of the changing intention to use cannabis in the next 12 months over time (Event rate ratio=0.95, 95% CI: 0.92-0.98). This means that even though the intention to use cannabis increased linearly by an event rate of 1.18 per occasion, it also declined at a rate of 0.95 per occasion. In terms of quadratic growth, there was no significant variation between ($\chi^2(19)=15.14$, $p>0.5$) or within schools ($\chi^2(1344)=617.24$, $p>0.5$), hence in all further models this was treated as a fixed factor.

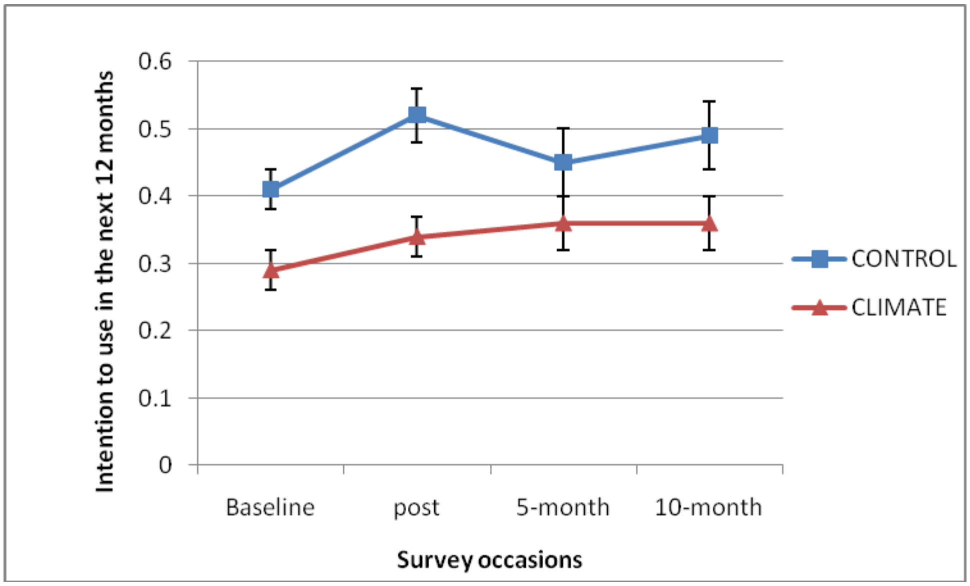
Conditional Model
School level effects

Intervention effects were explored in Model 4. According to this model, intervention was not a significant predictor of the intention to use cannabis in the next 12 months (Event rate ratio= 0.71, 95% CI: 0.47-1.08), linear (Event rate ratio=1.00, 95% CI: 0.93-1.07) or quadratic growth (Event rate ratio=1.01, 95% CI: 0.96-1.07) over time.

Intention to use meth/amphetamine in the next 12 months

The average reported intention to use meth/amphetamine in the next 12 months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 26.

Figure 26: Intention to use methamphetamine in the next 12 months for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.29 (0.03)	0.34 (0.03)	0.36 (0.04)	0.36 (0.04)
CONTROL	0.41 (0.03)	0.52 (0.04)	0.45 (0.05)	0.49 (0.05)

HGLM procedures utilising a Poisson distribution was utilised to analyse student's self-reported data on intention to use methamphetamine in the next 12 months.

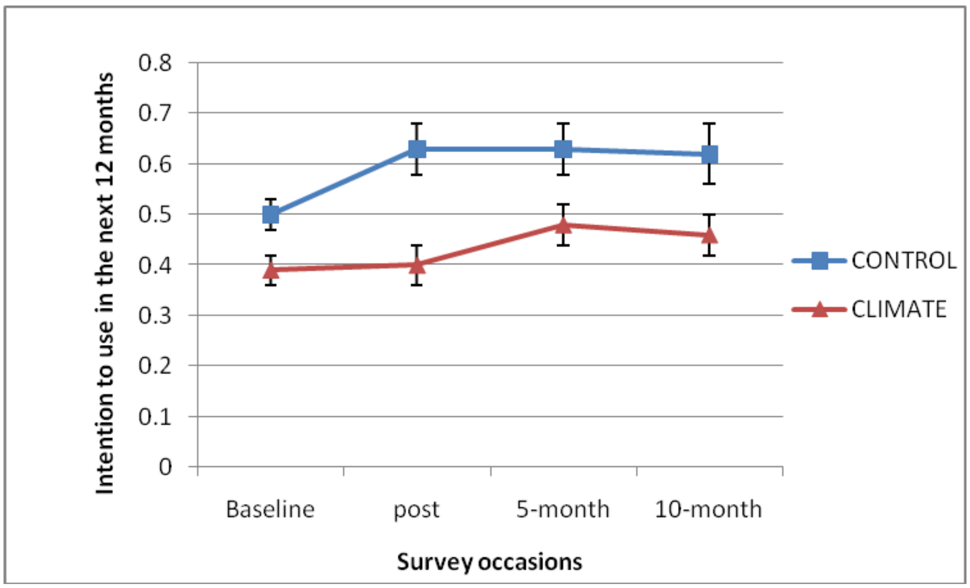
HGLM: The unconditional linear model revealed that 5.99% of the variance could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was not considered appropriate to proceed with HGLM procedures. Hence, data were analysed using single level analyses.

Analysis of covariance: Baseline intention to use methamphetamine score was entered as a covariate in each of the three analyses. Immediately post intervention there was a significant difference between the CLIMATE and the CONTROL group ($F(2,1200)=5.96$, $p=0.01$). Students in the CONTROL group had significantly greater intention to use methamphetamine in the next 12 months in comparison with the CLIMATE group. For both groups, however, the intention to use methamphetamine was very low. At both five months (F (2,1059)=1.15, p=0.28) and 10 months (F (2,972)=1.14, p=0.29) post intervention the CLIMATE and CONTROL group were no longer significantly different in their reported intention use methamphetamine in the next 12 months. Once again, both groups reported minimal intention.

Intention to use ecstasy in the next 12 months

The average reported intention to use ecstasy in the next 12 months for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 27.

Figure 27: Intention to use ecstasy in the next 12 months for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.39 (0.03)	0.40 (0.04)	0.48 (0.04)	0.46 (0.04)
CONTROL	0.50 (0.03)	0.63 (0.05)	0.63 (0.05)	0.62 (0.06)

HGLM procedures utilising a Poisson distribution was utilised to analyse students' self-reported data on intention to use ecstasy in the next 12 months.

<u>HGLM:</u> The unconditional linear model revealed that 6.87% of the variance could be accounted for at the between school level. Therefore, utilising the criteria set out by Lee

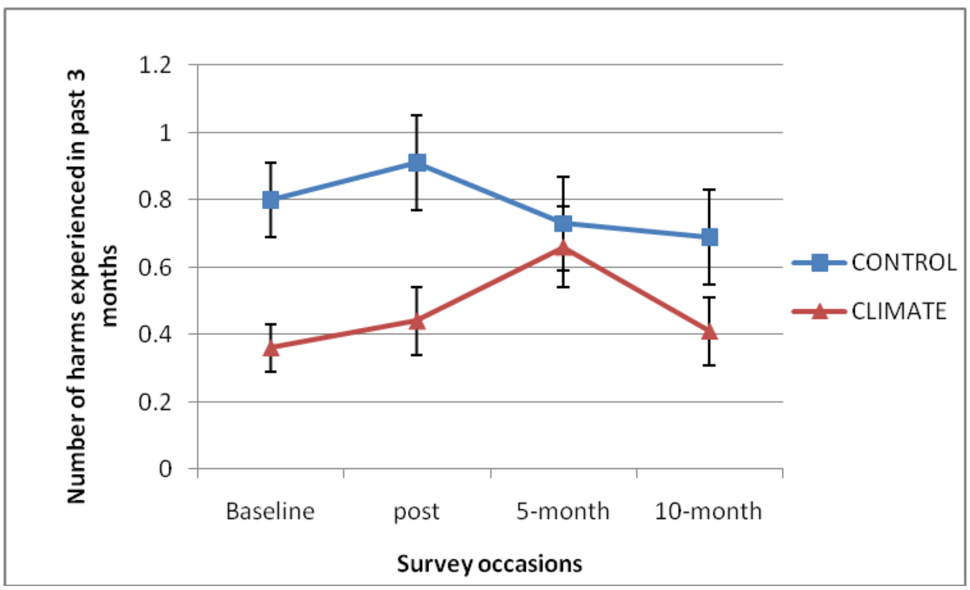
[267], it was not considered appropriate to proceed with HGLM procedures. Hence, data were analysed using single level analyses.

<u>Analysis of covariance:</u> Baseline intention to use ecstasy scores were entered as a covariate in each of the three analyses. Immediately post intervention there was a significant difference between the CLIMATE and the CONTROL groups (F (2,1199)=10.64, p=0.001). Students in the CONTROL group had significantly greater intention to use ecstasy in the next 12 months in comparison with the CLIMATE group. For both groups, however, the intention to use ecstasy was very low. A trend in this direction remained at five months follow-up (F(2,1055)=5.21, p=0.02). At 10 months follow-up there was no significant difference between the CLIMATE and CONTROL groups in their intention to use ecstasy in the next 12 months (F(2, 970)=1.04, p=0.31). On all occasions, however, the intention of both groups to use ecstasy is minimal.

Cannabis-related problems /harms

The reported frequency of cannabis related harms in the last three months for each survey occasion for the CLIMATE and CONTROL groups is shown in **Figure 28**

Figure 28: Frequency of cannabis related harms for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.36 (0.07)	0.44 (0.10)	0.66 (0.12)	0.41 (0.10)
CONTROL	0.80 (0.11)	0.91 (0.14)	0.73 (0.14)	0.69 (0.14)

HGLM procedures utilising a Poisson distribution was utilised to analyse the frequency of cannabis related harms in the last three months.

<u>HGLM:</u> The unconditional linear model revealed that 13.02% of the variance could be accounted for at the between school level. Therefore utilising the criteria set out by Lee [267], it was considered appropriate to proceed with HGLM procedures. This unconditional model revealed that there was significant variation in the number of cannabis related harms experienced both within ($\chi^2(1711) = 4682.38$, $p<0.001$) and between ($\chi^2(20) = 122.16$, $p<0.001$) schools.

Unconditional models: The second unconditional model used a linear growth term to characterise the change in number of cannabis related harms over time. Time was centred to allow the intercept to reflect the number of cannabis related harms experienced at post intervention. The unconditional linear model indicated that at immediate post-test, on average the number of harms experienced as a result of cannabis use in the last three months did not differ significantly from zero (Event rate ratio=0.98, 95% CI: 0.63-1.54). The model revealed that the experience of cannabis related harms was increasing linearly over time at a rate of 1.37 harms per occasion (Event rate ratio=1.37, 95% CI: 1.25-1.50). There was significant variation in the number of harms experienced in the last three months as a result of cannabis use, both within ($\chi^2(1415)=4566.47$, $p<0.001$) and between ($\chi^2(19)=119.02$, $p<0.001$) schools. The variation between schools accounted for 14.8% of total explainable variance. In terms of linear growth in the number of cannabis related harms, there was no significant variation between ($\chi^2(19)=30.07$, $p=0.05$), or within schools ($\chi^2(1415)=823.07$, $p>0.5$) schools. As the between schools variance was bordering on significant in the model, it was treated as a random effect in future models. Variation within schools in linear growth was constrained to zero in all future models.

The third unconditional model utilised a linear and quadratic growth term to characterise the pattern of change in the number of cannabis related harms (last three months) over time. Quadratic growth was not a significant predictor of the changing number of cannabis related harms experienced over time (Event rate ratio=1.00, 95% CI: 0.85-1.18). Hence, quadratic growth was not added to any further models.

Conditional Models:
Individual effects
Gender was added as a school level predictor in Model 4. Gender significantly predicted post-test scores. Specifically, at post-test, the number of harms experienced by females was significantly lower than for males (Event rate ratio= 0.53, 95% 0.33-0.84). Gender was not a significant predictor of linear growth in the number of harms experienced as a result of cannabis use over time (Event rate ratio= 1.11, 95% CI: 0.88-1.40) and hence was removed as a predictor of linear growth over time.

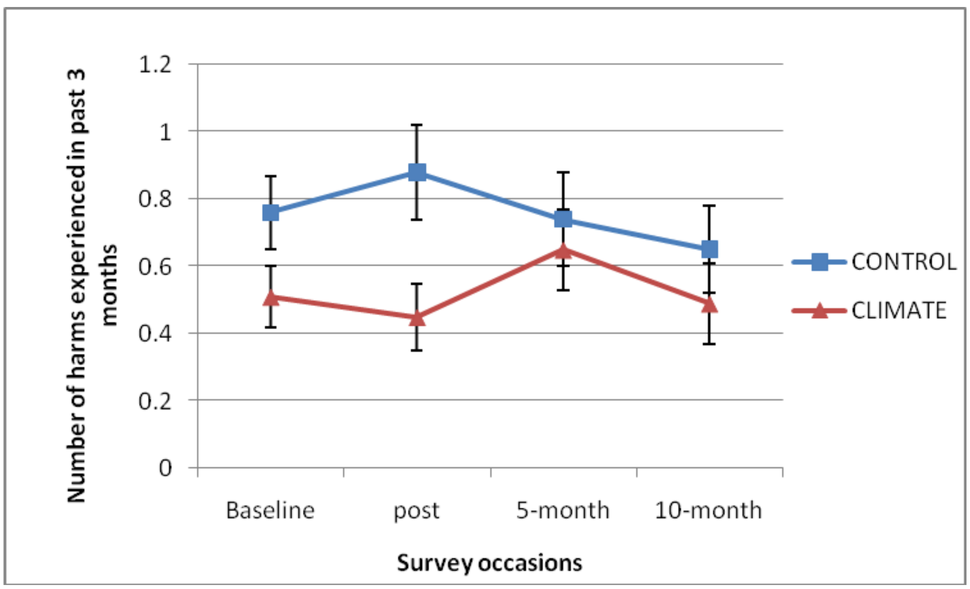
School level effects

Intervention effects were explored in Model 5. According to this model, intervention was not a significant predictor of the number of harms experienced post-intervention (Event rate ratio=0.58, 95% CI: 0.24-1.40) and was not a significant predictor of linear growth (Event rate ratio=1.18, 95% CI: 0.93-1.51). Intervention also did not interact with gender in predicting post-test scores (Event rate=1.04, 95% CI: 0.42-2.52).

Harms resulting from psychostimulant use

The reported frequency of psychostimulant related harms for each survey occasion for the CLIMATE and CONTROL groups is shown in Figure 29.

Figure 29: psychostimulant related harms for each survey occasion for the CLIMATE and CONTROL groups



	Baseline (SE)	Post (SE)	Five month (SE)	10 month (SE)
CLIMATE	0.51 (0.09)	0.45 (0.10)	0.65 (0.12)	0.49 (0.12)
CONTROL	0.76 (0.11)	0.88 (0.14)	0.74 (0.14)	0.65 (0.13)

HGLM procedures utilising a Poisson distribution was utilised to analyse the data on psychostimulant related harms.

HGLM: The unconditional linear model revealed that 7.63% of the variance could be accounted for at the between-school level. Therefore, utilising the criteria set out by Lee [267], it was not considered appropriate to proceed with HGLM procedures. Hence, data were analysed using single level analyses.

Hierarchical regression:

Post-intervention harms: Total psychostimulant-related harms for baseline were entered in the first step of the regression; gender was entered in the second step; and intervention condition in the third. Table 17 provides the R square change scores for each step of the regression and corresponding critical values.

Table 17: R square change scores for each step of the regression and corresponding critical values for the prediction of post-intervention scores

Step	Variables in equation	R square change	F value	P value
1	Baseline harms	0.292	495.74	P<0.001
2	Gender	0.003	3.92	P=0.057
3	Intervention	0.002	2.40	P=0.12

The number of harms experienced by a student at baseline was a significant predictor of the number of harms experienced at post-intervention. Gender did not add significantly to the prediction of post-intervention scores and nor did intervention condition.

Five-month follow-up harms: Total psychostimulant related harms for baseline were entered in the first step of the regression; gender was entered in the second step and intervention condition in the third. Table 18 provides the R square change scores for each step of the regression and corresponding critical values.

Table 18: R square change scores for each step of the regression and corresponding critical values for the prediction of five-month follow-up psychostimulant related harm scores.

Step	Variables in equation	R square change	F value	P value
1	Baseline harms	0.198	261.20	P<0.001
2	Gender	0.002	2012	P=0.15
3	Intervention	0.000	0.048	P=0.82

The number of harms experienced by a student at baseline was a significant predictor of the number of harms experienced at five-month post-intervention. Gender did not add significantly to the prediction of five-month scores and nor did intervention condition.

10-month follow-up harms: Total psychostimulant related harms for baseline were entered in the first step of the regression; gender was entered in the second step and intervention condition in the third. Table 19 provides the R square change scores for each step of the regression and corresponding critical values.

Table 19: R square change scores for each step of the regression and corresponding critical values for the prediction of 10-month follow-up psychostimulant related harm scores.

Step	Variables in equation	R square change	F value	P value
1	Baseline harms	0.081	85.50	P<0.001
2	Gender	0.004	3.89	P=0.049
3	Intervention	0.000	0.058	P=0.81

The number of harms experienced by a student at baseline was a significant predictor of the number of harms experienced at 10 months post intervention. There was a trend in the direction of gender predicting 10-month scores, but intervention condition did not contribute any further to the prediction of psychostimulant related harms at the 10-months follow-up.

Program evaluation

Student Evaluation of CLIMATE Schools

A total of 749 CLIMATE Students completed the evaluation survey. The majority of students moderately or strongly agreed that the cartoon story was an enjoyable way of learning (71%), helped to keep their interest (63.1%), and that they would like to learn other PDHPE theory topics through cartoon stories (63%). In general, students moderately or strongly agreed that the information on cannabis and psychostimulants and how to stay safe was easy to understand (77%), learn (76.5%), and remember (59.8%).

In terms of the classroom activities, 63.9% moderately or strongly agreed that the classroom activities helped them to further understand the information on cannabis and psychostimulants and how to stay safe. Just over 60% of students moderately or strongly agreed that if the need arose, the classroom activities had helped them to understand how to apply the information they learned to their own lives and a similar number stated that they did plan to use the information in their own lives in the future.

Table 20 provides a mean rating and standard deviation for each evaluation item. For each item the mean rating shows that on average students had a positive attitude towards all aspects of the program.

Table 20: Mean scores (and standard deviations) for students on evaluation items.

Item	Mean (SD)
The cartoon story was an enjoyable way of learning PDHPE theory.	5.72 (1.4)
The cartoon story helped to keep my interest while I learned the information.	5.56 (1.53)
The cartoon story was relevant to current or future experiences in my life or in the lives of my peers.	5.18 (1.74)
The information on psychostimulants and cannabis, and how to stay safe in the cartoon story was easy to understand.	6.02 (1.20)
The information on psychostimulants and cannabis, and how to stay safe in the cartoon was easy to learn.	6.01 (1.16)
The information on psychostimulants and cannabis, and how to stay safe in the cartoon was easy to remember.	5.54 (1.40)
I would like to learn other PDHPE theory topics through cartoon stories.	5.53 (1.74)
The classroom activities helped me to further understand the information on psychostimulants and cannabis, and how to stay safe.	5.63 (1.34)
If the need arose, I think the classroom activities have helped me to understand how I could apply the information I learned to my own life.	5.58 (1.36)
If the need arises in my own life or the lives of those around me, I plan to use the information I learned in this program.	5.56 (1.46)

Scores based on the following coding:
1 = Strongly disagree, 2= moderately agree, 3= slightly agree, 4 = undecided, 5= Slightly agree, 6 = Moderately agree, 7 = Strongly agree.

Teacher Evaluation of CLIMATE Schools: Alcohol Module

Teacher characteristics

In total, 36 teachers implemented CLIMATE Schools: Psychostimulant and Cannabis Module in 48 class groups. Thirty-four teachers who implemented the program reported returning the evaluation survey; two were not received as they were lost in the mail. The teachers who implemented the program ranged in age from 22 to 63 years, with a mean age of 33.5 years (SD=11.80). Forty-nine percent of teachers were male and 51% were female. These teachers ranged from having 0.5 to 37 years of teaching experience, with a mean of 10.22 years (SD=9.64).

Computer component

Teachers reported that the computer program was very effective in holding students' attention, with 42% endorsing that it held the students attention 'very well' and the other 45% endorsing 'well'. According to teachers, students could recall the information being taught in the computer component 'very well' (26%) or 'well' (61%). No teachers rated recall as 'poorly' or 'very poorly'. Teachers endorsed that 54.8% of students liked the program 'a lot', with 26% liking it 'a little'. According to the teachers, only 6% of students 'disliked' the program.

In terms of implementing a computer-based program, the vast majority reported that it was 'very easy' (45%) or 'easy' (42%) to implement, with 10% reporting average levels of ease. Only 3% of teachers reported that it was 'difficult' to implement. The ease with which teachers accessed computer resources in their schools was rated as 'very easy' by 16%, 'easy' by 29% of teachers, 'average' by 32% of teachers, and 'difficult' or 'very difficult' by 19.4% and 3.2% of teachers respectively.

Program manual and activities

Nearly all teachers rated the educational quality of the additional classroom activities positively with 48% of teachers endorsing that they were 'very good' and 45% endorsing 'good'. The remaining 6.5% reported the quality to be average. No teachers reported the quality to be below average. Fifty-eight percent of teachers reported that the activities were 'very easy' to prepare, with a further 26% endorsing that they were 'easy' to prepare. Teachers also believed that the activities helped to reinforce the information on cannabis and psychostimulants to students, with 40% believing the activities did this 'very well' and 57% believing that they did this 'well'.

Overall program

All the teachers who implemented the CLIMATE Schools: Psychostimulant and Cannabis Module rated it as either 'very good' (52%) or 'good' (48%) as an educational program. No teachers reported the program to be 'average', 'poor' or 'very poor'. They endorsed the program as either ‘much better’ (40%) or ‘better’ (50%) than other educational programs. Ten percent of teachers rated the program quality to be the same as other programs. No teachers thought it was the ‘worse’ or ‘a lot worse’ than other programs. Those that implemented the program were satisfied that it met the educational outcomes detailed in the new PDHPE syllabus, with 68% saying it complied ‘very well’ and 29% ‘well’ and 3.2% ‘average’. No teachers thought that the compliance with the syllabus was ‘poor’ or ‘very poor’.

Nearly all the teachers who implemented the CLIMATE Schools: Psychostimulant and Cannabis Program endorsed that they would be ‘very likely’ (68%) or ‘likely’ (29%) to use it in the future. Three percent of teachers were undecided. None of the teachers reported that they would not use the program in the future. Likewise, nearly all teachers reported that they were either ‘very likely’ (68%) or ‘likely’ (26%) to recommend CLIMATE Schools: Psychostimulant and Cannabis Module to other teachers in the future. The remaining 7% reported that they were ‘unlikely’ or ‘very unlikely’ to recommend the program to other teachers in the future.

Discussion

The CLIMATE Schools: Cannabis and Psychostimulant Module was effective in increasing drug-related knowledge and decreasing pro-drug attitudes. The capacity to positively impact on knowledge and attitudes is consistent with a large body of previous research on school-based drug prevention [7, 13, 18, 19, 28, 84, 94, 96, 99, 286]. Immediately after the intervention, students who received the CLIMATE Schools: Psychostimulant and Cannabis Module had significantly higher levels of knowledge than the CONTROL group. The absolute difference in knowledge between groups did diminish over time, but was still significantly different at 10 months post-intervention.

Although these results are consistent with previous research, they directly challenge the notion that harm-minimisation information is too complex for young people to learn, a justification used to support the teaching of simpler abstinence based messages alone [125, 129]. Specifically, consistent with a harm-minimisation approach, the knowledge taught in the current module was to strongly encourage young people to refrain from drug use, but it also provided the knowledge required to practice harm-minimisation skills to prevent harms as a result of one’s own or other people’s drug use. The demonstrated increase in knowledge in the CLIMATE group provides solid evidence that young people can learn harm-minimisation information[8]. These findings are consistent with previous CLIMATE Schools research [11, 12, 20] and the SHAHRP program which was also conducted in Australia [10].

The heartening aspect of the results from the current study is that students in both the CLIMATE and CONTROL groups predominantly had very negative attitudes towards drug use from the outset of this study, attitudes which became even more negative in the CLIMATE group after they received the intervention.

Although it is important to change young people's attitudes to drug use, the research has clearly demonstrated that this is not sufficient to achieve behavioural change [91, 92] and the demonstration of behavioural change is what is considered to be essential [7, 19, 28, 33, 36, 93-96]. The behavioural change of interest in this study is to alter the otherwise predicted course of development, which is either to suppress drug use behaviour or keep it from occurring [97].

The CLIMATE program was effective in altering the predicted course of development for ecstasy use. Specifically, immediately after the intervention it was evident that the CLIMATE program was effective in delaying initiation to ecstasy use in comparison with the CONTROL group. Even though this difference between groups diminished by the five month follow-up, it is an important result as a substantial body of evidence has shown that early onset drug use is a risk factor for developing a substance use disorder in later life [74-81]. The CLIMATE program was also effective in decreasing the frequency of ecstasy use with this difference gradually diminishing over time. Decreasing the use and frequency of ecstasy use is vital, because even though serious acute adverse events related to ecstasy may be relatively rare, when they do occur they are unpredictable and are associated with considerable morbidity and mortality [72]. Although is it impressive to demonstrate a decrease in the frequency of ecstasy use in the current research, it is essential to also bear in mind that the overall prevalence of use in the current sample was very low and could at most be described as experimental use. The low prevalence of use is also the most likely reason for why the CLIMATE intervention did not impact on ecstasy related harms.

The CLIMATE intervention did not delay initiation to cannabis use or impact on cannabis related harms, but it was effective in decreasing the frequency of cannabis use for females, although not for males. Regular use has been identified as a risk factor for later problematic cannabis use [194, 270, 287]. The evidence suggests, however that if adolescents can moderate the frequency of their use, they have improved their odds of better outcomes in

[8] It is important to be clear that, consistent with a harm-minimisation framework, the harm-minimisation message adopted in the current programs was to strongly encourage abstinence as a desirable outcome, while accepting that some young people will use drugs and hence provide information and skills to attempt to minimise or prevent the consequences or effects of alcohol and other drug use on both the individual and society.

the longer term [194]. Although the frequency of cannabis use in the current sample is typical of occasional and experimental cannabis use, even the smallest reductions in frequency of use may assist in subduing the growth in trajectories to riskier levels of use in the future. This age group is an important one; the evidence suggests that the peak risk for developing abuse and dependence is between 14-20 years of age with the greatest risk being after the age of 16 [288].

The fact that the CLIMATE program was not successful in delaying initiation to cannabis use is of no surprise. Prior to the development of this program, it was well recognised that cannabis prevention interventions needed to be delivered by age 13, rather than 15-16 years of age. Large-scale Australian population surveys show that by 13 years of age, nearly one in 10 young Australians have tried cannabis and that by 15-16 years of age, the figure is in excess of 20% [41]. Prevention research clearly indicates that for prevention to be effective in delaying initiation, it needs to be delivered early, before experimentation occurs and that by 15 years of age, it is too late to deliver a standalone intervention for the prevention of cannabis use, as has been done in the current trial. For cannabis in particular, the window of opportunity for prevention is narrow. Specifically, recent longitudinal research suggests that the transition to abuse and dependence occurs more rapidly for cannabis than for other drugs [81]. The research does, however, suggest that ongoing interventions are also important, as young people who cease cannabis use or decrease the frequency of use have better prognoses for the future [194]. This supports the need for sequential and developmentally appropriate interventions, which have now been catered for within the CLIMATE Schools drug prevention resource.

The inability to demonstrate change in the number of cannabis related harms may largely be a result of the low prevalence of use and sporadic nature of cannabis use in the current sample. Specifically, at post-test the majority of students reported using cannabis less than once every three months, with the vast majority reporting no use at all.

The lack of preventive effects for males in changing the frequency of cannabis use is consistent with a growing body of evidence which shows that school-based prevention programs may be less effective for males than females [11, 43, 244, 289-292]. The inability of school-based prevention programs to reach males as effectively as females is of considerable concern. Although there is some evidence of converging rates of cannabis use between young males and females [64, 285], considerable evidence suggests that males are not only more likely to have tried cannabis, but are also more likely to become long-term problematic users [270]. The cannabis use of male students in this sample was also elevated in comparison with females. At post test, males were significantly more likely than females to have ever used cannabis and used cannabis more frequently. Similar gender differences were also apparent for meth/amphetamine and ecstasy use. Males were significantly more likely to have ever used meth/amphetamine at post test, in the last three months, and used more frequently in the last 12 months. The majority of these differences between males and females remained consistent over the duration of the study. Likewise for ecstasy, with the exception of lifetime use, males were more likely to have used ecstasy in the last three months and used more frequently in the last 12 months.

The propensity for males to be a higher risk group may be a result of the differences in level of risk and protective factors for drug use experienced by males in comparison with females [293]. In particular, research suggests that the biological and social consequences of drug use may be stronger protective factors for females in comparison with males; in particular, greater social sanction against drug use by females in comparison with males [293, 294]. Whereas for males, it may be higher levels of impulsivity or the need to use drugs with the motivation of enhancing their capacity to cope that explain some of the increased levels of drug use, more so than for females [295]. Gaining a greater understanding of the risk and protective factors which lead to gender differences in drug use is essential because a more comprehensive understanding of these factors could assist in making prevention program equally and more effective for both males and females.

The CLIMATE Schools program was not effective in changing meth/amphetamine use. This result may explained by the low levels of use in the sample (4-5%) and the lack of variation in use both within and between schools over the study duration, which were evident in the HLM analyses. Positive school-based drug prevention program effects typically involve subduing the growth in drug use, rather than decreasing drug use over time [97]. With no variation in drug use in either the CLIMATE or CONTROL group, it is near impossible to demonstrate such program effects. This lack of growth or change in meth/amphetamine use over the 12 months course of this study is potentially consistent with large scale surveys which are showing a significant, but very gradual decline in meth/amphetamine use over time [41, 62]. Given meth/amphetamine use is on the decline [41, 62], and that drug prevention programs are more effective if they focus on a single drug at one time [33], these results suggest it may be more effective for future programs to target ecstasy use, rather than ecstasy and meth/amphetamine use combined. Such a program focusing on ecstasy use alone is currently being developed.

As the prevalence of meth/amphetamine use is low and potentially declining, in the future it may also be better addressed in a targeted rather than universal prevention programs. Obviously, providing targeted interventions may be challenging in most school environments, given the legal responsibilities of reporting illicit drug use. This suggests that to provide essential preventive information to young people who do use illicit drugs, that it may be beneficial to discretely embed targeted programs within universal programs to prevent stigmatisation and identification from occurring. The CLIMATE platform provides an ideal opportunity for this to occur. Specifically, if students complete the cartoon-based drama individually and with relative anonymity, they could be directed to either a universal or targeted intervention based on a confidential and anonymous computerised drug-use questionnaire, without anyone having to know.

For any drug prevention program, there is a Catch-22 in the capacity to demonstrate behavioural change in drug use. Specifically, for drug prevention to be optimally effective, it needs to be implemented prior to the occurrence of experimentation. To demonstrate behavioural change, however, drug use needs to be occurring and varying in the population. Without a sufficiently long follow-up period in which drug use may be monitored for increases, the capacity to demonstrate changes may not always be possible, especially given that observable behavioural change as a result of these programs is often not immediate, but is often delayed [34, 158, 268, 296, 297]. Following up students for a further 12 months in the current study would not have been feasible or likely permitted by schools, given that students would then have been in their final year of school, where the academic pressure is greatest. Irrespective of the capacity to conduct longer-term follow ups, the difficulty in demonstrating program effects is further compounded in research on illicit drug use, since even when illicit drug use is fully fledged, the prevalence and related harms in the overall population are low [46, 62]. For this reason, research on the prevention of illicit drug use often relies on a measure of intention to use drugs in the future as a measure of program effect [26, 159]. In the current study, the CLIMATE Schools: Cannabis and Psychostimulant program was found to be effective in decreasing students' intention to use Meth/amphetamine and ecstasy over the next 12 months at post-test intervention, with this difference remaining at five-months post-intervention for ecstasy use alone. This capacity to subdue the intention to use drugs is important as intention has been shown to be an excellent predictor of future behaviour [298, 299]. Even demonstrating an impact on the intention to use drugs in the future is difficult in the current study, because (happily) the overall intention of all students (even in the CONTROL group) was very low.

The results of the current study need to be considered in light of a number of limitations. First, despite randomisation, the CONTROL group was typically a higher risk group than the CLIMATE group at baseline on a number of drug use measures. Although all the analyses took baseline scores into account, this does not necessarily control for the possibility that the CONTROL group may have a higher-risk trajectory over time.

A second limitation concerns the attrition of high-risk students which is a common occurrence in school-based prevention research [19, 43, 110, 112, 134, 150, 155-164, 300]. This attrition of high-risk students has the potential of limiting the external validity of research findings as it may no longer be possible to generalise these findings to students at higher risk. It may also result in an overestimation of program effects since a group who are potentially more resistant to prevention are absent from the analysis. However, this attrition of high-risk students can also lead to an overly conservative test of the prevention program effects, due to the more restricted range of scores on outcome variables. In the current research, there was no evidence of differential attrition, which suggests that the prevention effects which have been detected are not spurious positive findings which have resulted from higher-risk subjects dropping out of the CLIMATE group rather than the CONTROL condition.

A third limitation is that, although the prevalence of ecstasy and meth/amphetamine use is representative of Australian students in general, as evidenced by comparison with other large-scale epidemiological surveys of drug use in Australia [41, 62], the prevalence of cannabis use at baseline in this sample was lower. Specifically, in the ASSADS the percentage of 15-year olds having ever tried cannabis is 22.8% in comparison with 12% in the current sample. In the NDSHS, 20% of 14-19 year olds report having used cannabis in their lifetime. Contrary to this concern, however, by the completion of the study the prevalence of cannabis use in the CONTROL group was commensurate with prevalence figures from the NDSHS. Hence, those students who did not receive the CLIMATE intervention were comparable with the general population on completion of this study. This may add further support for the intervention because it suggests that the CLIMATE intervention may have been successful in subduing expected population trends for cannabis use, even though not significantly. Although the initial lower levels of cannabis use may limit the external validity of these results; to the contrary, because of the restricted range of use, they may also have made it more difficult to demonstrate such positive program effects.

As is the case with the majority of evaluations of school-based drug prevention programs, it is difficult to find a "true control"; that is, schools that have not received any intervention [198]. The inability to find control schools is recognised to lead to an overly conservative test of prevention effects. In the current study, of the CONTROL schools who provided information on their drug education programs, four out of eight had delivered drug prevention programs pertaining to cannabis and psychostimulant use, all of which were greater in dose than the current program. An additional concern, given that there is no published data on the effectiveness of these programs currently delivered in schools, is that the only conclusion that can be drawn is that the CLIMATE program is either more or equally effective than programs currently being delivered in schools. Given that Australian Government Department of Education, Science and Training has released principles of effective drug education [14] which state that educators should use programs which have been evaluated and show good outcomes, it is important than in the future evaluations of school-based drug prevention programs currently being delivered in schools, be made available in the public domain to teachers, to help inform program choices.

The final limitation pertains to the accuracy of collecting self-report data on substance use. Self-report data is commonly collected in school-based studies as it is relatively easy to collect [301] and unobtrusive, whereas the use of biological measures is aversive and encourages attrition [97]. There is some concern, however, that self-report data may be prone to inaccuracies because young people attempt to either appear more or less socially desirable, deliberately provide random responses or are just inattentive [302, 303]. In a comprehensive review of studies assessing the use of self-report with adolescents, significant evidence was found to support the validity of self-report of alcohol and other drug use with adolescents [303]. In addition, in a study which involved the collection of drug-use data in schools, subjects self-report data were found to be highly valid, with only few students providing extreme response bias tendencies [302]. When school students' self-reported drug use has been verified using reciprocal best friend report, it has also been found to be highly accurate [301]. In the current study, assurances of confidentiality and anonymity were also repeatedly provided during survey administration [254] and clear information was provided about the anonymity of individuals and schools in the provision of results [97], factors which have both been shown to enhance self-report accuracy .

In conclusion, compared to the cannabis and psychostimulant education currently delivered in schools, the Climate Schools: Psychostimulant and Cannabis Module demonstrated a greater capacity to teach young people the information necessary to minimise cannabis- and psychostimulant-related harm. It was also effective in modifying pro-drug attitudes. A computer-delivered harm-minimisation program was more effective than drug education as usual in reducing the uptake of ecstasy use and decreasing the frequency of its use. Changes in cannabis use were evident for females only, with students who received the CLIMATE intervention using cannabis less frequently. No changes were demonstrated for meth/amphetamine use behaviour. Intention to use in the future is a good predictor of future behaviour; importantly, the CLIMATE intervention was successful in reducing intent to use ecstasy and methamphetamine, suggesting possible positive ongoing program effects. These findings provide further evidence that school-based drug prevention programs based on a harm-minimisation approach and delivered by computer can offer an innovative new platform for the delivery of prevention education for both licit and illicit drugs in schools. The mode of delivery was certainly welcomed by both students and teachers, with the latter rating this program as superior to other drug prevention approaches and reporting that they would be likely to continue using this program in the future. The CLIMATE drug prevention programs now offer a suite of sequential and developmentally appropriate interventions catering for both licit and illicit drug use. What remains to be done is to trial the complete suite and assess if this enhances programmatic effects.

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