

**Risk Perception and Reasoning Performance in
High and Low Risk Adolescents**

by

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**A thesis submitted in conformity with the requirements
for the degree of Doctor of Education
Department of Human Development and Applied Psychology
Ontario Institute for Studies in Education
of the University of Toronto**

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Abstract

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The goal of this exploratory research was to examine whether high and low risk male adolescents differed on a group of measures associated with risk perception and risk behaviour. Based on previous research, it was expected that high risk adolescents would consistently report and display more risk related behaviours than low risk adolescents. Cognitive ability and thinking dispositions were examined as correlates of performance on these tasks. A sample of ninety male adolescents were subdivided into two groups - a high or low risk group based on the frequency of school suspensions. Tasks included: two self-report measures consisting of a risk perception questionnaire and a future life events inventory; two reasoning tasks consisting of a gambling task and a marble task; a cognitive ability measure; and a thinking dispositions questionnaire. The high risk students reported less fear of the dangers associated with high risk activities, displayed lower optimism, and these students were also the high risk choosers on the gambling task of cost-benefit reasoning. No differences were found on the marble reasoning task. Some evidence was found for a "syndrome of problem behaviour", as students who engaged in one high risk activity were more likely to engage in other high risk activities. High and low risk students did not differ in cognitive ability and some trends were found which suggest that thinking dispositions may explain differences between the two groups of students. The implications of these findings are discussed in terms of a somatic marker hypothesis (Bechara et al., 1994) and a generic dual process framework for reasoning (Stanovich & West, 2000).

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Introduction

The phenomenon of adolescent risk taking behaviour continues to engage researchers, intrigue theorists, and challenge professionals. There is concern that adolescents engage in behaviours which are detrimental to both their health and well-being. This public perception is often fuelled by sensational media coverage reporting the negative outcomes associated with adolescent involvement in certain behaviours and activities deemed risky by adult society and community norms (Furby & Beyth-Marom, 1992; Mervis, 1984; Turner, 1999). But researchers disagree on the best ways to define, measure, interpret, and prevent such behaviours (Arnett, 1999; Mervis, 1984; Moore & Parsons, 2000; Silbereisen, 1998). One of the recurring themes throughout the literature is that a clearer understanding of adolescents' tendency to engage in risky behaviour and activities should translate into an effective prevention programme (Bell & Bell, 1993; Beyth-Marom, Fischhoff, Quadrel, & Furby, 1991; Brown, 1999; Carey, 1999; Mervis, 1984). Yet the prevalence of substance use/abuse, unprotected sexual intercourse, and improper or inappropriate recreational vehicle driving are three risk behaviours that have remained high over the past decade, despite social efforts to reverse such trends (Bell & Bell, 1993; Irwin, 1993; Jonah, 1986; Kandel & Logan, 1984; Morehouse & Tobler, 2000). According to Furby and Beyth-Marom (1992), the development of intervention programmes and social policies designed to curb adolescent risk taking behaviour may be based on folk psychology rather than empirical research.

The goal of this exploratory research was to examine the phenomenon of risk taking in adolescents along several dimensions. Specifically, this investigation examined whether such variables as cognitive ability, personality or thinking dispositions, and mechanisms of rational thinking in two real-life decision making tasks are potential influences of risk taking and risk behaviour perception in two different subgroups of male adolescents - a high and low risk group of students based on the frequency of suspensions from school.

Of particular interest was the issue of whether risk taking is a real phenomenon in adolescents or whether it has been inflated by folk psychological beliefs. If it is a real phenomenon, then one might expect a high association between risk-related activities and beliefs, or a "syndrome of problem behaviour." Finally, individual difference analyses may further elucidate whether a syndrome exists and which adolescents are more likely to engage in risk-related behaviours.

Risk taking behaviour is a complex and multilayered phenomenon. It involves (either explicitly or implicitly) an assessment of risk behaviours (e.g. using cost-benefit reasoning, judging the probability of outcomes using base rate information) and making choices according to some decision rule (Fischhoff, 1988; Kahneman & Tversky, 1972, 1984; Slovic, Fischhoff, & Lichtenstein, 1979, 1986; Tversky & Kahneman, 1973; Tversky & Kahneman, 1974). To increase our understanding of whether and why a teenager chooses to take (or not take) risks, it is essential that analyses of the decision making process be made from the perspective of adolescents. If analyses indicate that adolescents' decision making processes are less than rational, interventions may be necessary to improve individual decision making. However, if environmental and social structures support the rational choice of excessive risk (from societal or adult points of view), then societal structures may need to be reviewed. The overall decision making competence among different subgroups of the adolescent population or the development of specific skills necessary to facilitate effective decision making is the focus of some studies (Furby & Beyth-Marom, 1992; Parsons, Halkitis, Bimbi, & Borkowski, 2000).

Several theories are posited in the literature to explain risk taking behaviour. Some researchers focus on a psychosocial framework and a syndrome of problem behaviour to identify personality variables or environmental determinants as "proneness" factors (Jessor, 1992; Jessor, 1998; Jessor, Donovan, & Costa, 1991; Jessor, Graves, Hanson, & Jessor, 1975; Jessor & Jessor, 1977). In a recent study, however, Gullone and Moore (2000) found that adolescent risk judgments were better predictors of risk behaviour than

personality traits. Others have protested that taking risks is a naturally occurring developmental task during the adolescent life stage, that many of the factors linked to "proneness" to problem behaviour actually represent normal, healthy development among adolescents, and that researchers need to distinguish between adaptive and maladaptive risk taking behaviour (Anderson, Bell, Fischer, Munsch, Peek, & Sorell, 1993; Baumrind, 1987). Thus, the issue can be formulated in terms of whether risk taking behaviour is a normative reflection of adolescence or whether it is a cause for concern based on descriptive models of behaviour. Although Irwin and Vaughan (1988) describe exploratory behaviour and experimentation with a wide range of behaviours as essential for normal adolescent development, Dryfoos (1990) and Hechinger (1992) have noted that adolescents tend to experience a disproportionately high degree of negative consequences associated with some risk behaviours. This finding raises concerns over whether adolescents are capable of making responsible decisions and rational choices regarding their own welfare (Dryfoos, 1990; Hechinger, 1992; Small, Eastman, & Cornelius, 1988). Recent studies have suggested that moral reasoning and engagement in risk activities are mediated by perceived behavioural competence (i.e. judgments of one's relation to society and society's collective norms or values (Goff & Goddard, 2000; Kuther, 2000; Kuther & Higgins-D'Alessandro, 2000). But not all adolescents engage in risky behaviours and not all adolescents choose the same risky behaviours to the same extent or for the same reasons (Takanishi, 1993). Furby and Beyth-Marom (1992) have observed that most studies of adolescent risk taking behaviour focus on the consequences of engaging in behaviours and activities deemed risky by adult society, but rarely consider the consequences to the teenager of not engaging in the behaviour. They emphasize that societal perceptions of adolescents depend on how we interpret and explain risk taking behaviour. Further, how society interprets and explains this phenomenon has implications for the design of educational programmes, clinical interventions, and social policies affecting youth.

Risk Taking in Adolescence

Perceptions of risk, the notion of optimistic biases in relation to future events, and decision making processes are important areas of study to explain risk taking behaviour. The following review of the literature on adolescent risk taking behaviour identifies five themes for discussion. First, the idea that adolescents entertain a personal fable of invulnerability (Elkind, 1967) which may impact on their ability to make competent decisions requires clarification because it is a widely-held belief in our culture and because of its implication that adolescents are not competent decision makers (Quadrel, Fischhoff, & Davis, 1993). Second, perceptions of risk with the goal of reducing risk and future oriented optimistic biases were examined. Third, a syndrome of problem behaviour requires attention because it suggests that a variety of "risky" behaviours or activities are interrelated (Benthin, Slovic, & Severson, 1993). Fourth, a decision making perspective considers risk and consequence perception by re-framing cost-benefit reasoning and base rate information as mechanisms of rational thinking from the perspective of adolescents (Furby & Beyth-Marom, 1992; Parsons et. al., 2000). Finally, a generic model of thought that distinguishes between cognitive capacities and personality or thinking dispositions is included for discussion because it has relevance for the study of adolescent risk perception and provides a framework for this investigation (Baron, 1985, 1988; Stanovich, 1999; Stanovich & West, 1998, 2000). The analytic strategy of the present investigation was to examine these five themes in a sample of adolescents that included a group of both low and high risk individuals.

Adolescent Invulnerability

There is a widely-held belief in mainstream North American culture that adolescents entertain a personal fable of invulnerability to future consequences. This idea is based on Elkind's (1967, 1985) conceptualization of egocentrism as a cognitive deficiency in adolescents. While Elkind (1967) notes that his theory of adolescent egocentrism is largely speculative, it has nevertheless contributed to societal assumptions and misconceptions in

explaining risk taking during adolescence (Bell & Bell, 1993). This theory has given rise to the widely-held belief of adolescent invulnerability which assumes that adolescents take more risks than adults. A basis for feelings of invulnerability has been proposed by Elkind (1967). He argues that adolescents entertain a personal fable which includes a belief in one's own personal uniqueness, omnipotence, and invulnerability. A personal fable suggests that adolescents overdifferentiate their thoughts and feelings from others and that young people are not competent decision makers because they either underestimate the likelihood of negative outcomes or overestimate the likelihood of positive outcomes (Bell & Bell, 1993). However, empirical evidence for the personal fable construct among adolescents is controversial in the literature and research has primarily compared adolescents and adults (Greene, Krmar, Walters, Rubin, Hale J., & Hale, L., 2000; Lapsley, 1993; Lapsley, Fitzgerald, Rice, & Jackson, 1989; Quadrel et al. (1993).

Some researchers have posited theories of egocentrism and sensation seeking as prominent factors contributing to a variety of problem behaviours in adolescence (Arnett, 1992a, 1992b; Frankenberger, 2000; Greene et. al., 2000; Zuckerman, 1979a; Zuckerman, 1984; Zuckerman & Neeb, 1980). For example, Zuckerman (1979a) conceptualized sensation seeking as a dimension of personality characterized by the need for varied or complex experiences and the willingness to take physical and social risks for the sake of such experiences. This view purports a predisposition toward a heightened level of arousal and sensation seeking as a normal part of adolescent development. The social environment and the options available within it become factors determining which activities one is drawn toward to either increase or decrease levels of arousal. Bell and Bell (1993), however, have expressed that a serious and dangerous implication of adopting a sensation seeking perspective to explain risk taking is the possible use of biophysical and medical intervention to deter risk taking behaviour. Further, according to Furby and Beyth-Marom (1992), there is no clear empirical evidence in the literature that risk taking is a result of sensation seeking. However, recent studies have suggested that risk-seeking or sensation-seeking in

adolescents and college students predicted such behaviours as alcohol consumption and delinquency and that a high personal fable combined with high sensation-seeking predicted risk taking behaviour (Greene et al. 2000).

Is there a fallacy in the literature and in folk psychology of a separate psychology for adolescence? Frankenberger (2000) found that a personal fable and imaginary audience are not confined to adolescents and extend into adulthood. Studies that compare adolescents and adults on risk and consequence perception question and challenge the widely-held assumptions that adolescents are not competent decision makers (Beyth-Marom, Austin, Fischhoff, Palmgren, & Jacobs-Quadrel, 1993; Quadrel et al., 1993). Trad (1993a, 1993b) found small differences in cognitive decision making processes for adults and teens. Cognitively, the same judgement errors operating in adults may also be operating in adolescents. However, despite these findings, studies also point to differences among different subgroups of the adolescent population. For example, Quadrel et al. (1993) found the high risk group of teens in their study to show a disposition toward feelings of invulnerability suggesting an optimistic bias. Klaczynski and Fauth (1995) described how future-oriented optimistic biases in adolescents may vary as a function of individual differences in both cognitive style and intellectual ability, but they considered a personal fable (i.e. overdifferentiation of thoughts and feelings from others) of uniqueness to explain why adolescents with low intelligence assigned greater probabilities to others in experiencing negative life events. In another study, Benthin et al., (1993) showed evidence to support a syndrome of problem behaviour (i.e. interrelationships of certain risky behaviours), but considered a "personal fable" of uniqueness and immortality to explain why adolescents in their study thought they could control, but not avoid risks. Lavery, Siegel, Cousins, and Rubovits (1993) examined the influence of personality variables on risk taking behaviour in adolescents with behaviour problems. Their findings supported a syndrome of problem behaviour, but showed evidence to suggest that adolescents identified with conduct disorders entertain a personal fable of invulnerability

toward the future negative outcomes of present behaviour. The idea of entertaining a personal fable was examined in the current study with the sample of low and high risk adolescents.

Risk Behaviour Perception

Risk behaviour perceptions may be conceptualized as regulating factors with the goal of reducing risk for an individual. In a study of adolescent risk perception by Benthin et al. (1993), student volunteers made quantitative judgements about the riskiness of behaviours and activities which were then related to judgements on a number of risk characteristics hypothesized to influence risk perception (e.g. knowledge, information value, peer influence, admiration etc.). Benthin et al. (1993) found that teens who participated in a risk activity perceived the risks to be smaller, better known, and more controllable than did nonparticipants. They also found low overall means for perceived peer influence. Two major findings were identified by Benthin et al. (1993) as requiring further investigation. First, the finding that risk taking actually provided benefits for the young person requires attention. While the expected utility of costs for adolescents engaging in risky behaviours has been documented from the perspective of adults, the expected utility of cost-benefit reasoning from the perspective of adolescents is only recently receiving attention. Second, the corroboration that certain risky behaviours tended to be interrelated supported Jessor and Jessor's (1977) problem-behaviour theory and suggested the existence of a syndrome of problem behaviour.

Perceptions of consequence are an important dimension to understanding risk taking behaviour. Furby and Beyth-Marom (1992) discussed how perceptions regarding the valence and magnitude attached to certain consequences may explain some perplexing findings in a study by Kegeles, Adler, and Irwin (1988) regarding the use of condoms among adolescents. These researchers found that teens' intention to use condoms was not related to beliefs regarding the degree to which condoms prevent disease or pregnancy, even for individuals who believed condoms would reduce the risk. The perceived riskiness

of sexual intercourse with and without condoms appeared to play no role in the decision to use condoms. Instead, the intentions to use condoms were correlated with beliefs regarding the degree to which they were easy to use, popular with peers, and the degree to which they facilitated spontaneous sexual activity. More recently, Parsons et al. (2000) examined the benefits and costs associated with the use of condoms and came to similar conclusions as Kegeles et al. (1988). These findings would be in contrast to the adult assumption that teens should attach greater importance to avoiding pregnancy and contracting sexually transmitted diseases. Differences in consequence perception were also reflected in Barnes' study (1981) of 7th graders and adults rating reasons for drinking alcohol. Barnes (1981) found that reasons relating to perceived conforming and status transformation (e.g. being part of the group etc.) were not endorsed. Instead, highly endorsed reasons related to psychological and physical satisfaction (makes me feel good, tastes good, to have a good time). Furby and Beyth-Marom (1992) have proposed that normative data on consequence perception and a decision making analysis of perceived consequences may provide us with valuable information on the salient risks associated with engaging in a variety of behaviour or activities.

Beyth-Marom et al. (1993) examined the perceived consequences of risky behaviours by comparing adults and adolescents on one-time versus regular behaviour of either engaging (yes decisions) or not engaging (no decisions) in risky activities. They found similar response patterns for both adults and adolescents suggesting shared beliefs about perceived consequences. Some differences were noted in that adolescents mentioned more negative consequences for no decisions. Beyth-Marom et al. (1993) explained this by suggesting that adolescents were either better able to think simultaneously about doing/not doing the behaviour, or had difficulty thinking about not engaging in the behaviour which led them to convert the task to thinking about engaging in the behaviour. Although the magnitude was smaller than expected, adolescents were also more likely than adults to mention social reactions (of peers, family, and other authorities) for both engaging

and not engaging in the risky behaviour. A risk perception questionnaire was used to examine these issues in the present study.

Future Oriented Optimism

Optimistic biases in relation to future life events have been linked to feelings of vulnerability or invulnerability to risky consequences. Weinstein's research (1980) which examined the role of optimism in college students is a classic study. Weinstein (1980) showed that people tend to be unrealistically optimistic, thus demonstrating a cognitive error in judgement. Factors influencing the amount of optimistic bias evoked by different events and the mechanisms that produce this bias were examined. Weinstein (1980) concluded that if the event was perceived as controllable and if people had a commitment or emotional investment in the outcome, an optimistic bias occurred because subjects brought to mind factors which would increase the likelihood of the event. When comparing themselves with an inappropriate standard or "stereotype victim," people concluded that their own risks were less than average. However, while Weinstein's study (1980) and others (Ditto & Lopes, 1992; Harvey, 1992) have provided important information on the problematic construct of perceptual biases, they do not allow us to explore whether adolescents are more likely to perceive themselves as invulnerable since comparative studies were not done. Other researchers have reported that depressed individuals show fewer optimistic biases in their probability estimates than nondepressed individuals (Pyszczynski, Holt, & Greenberg, 1987), that males are more optimistic than females (Nurmi, 1989), and that more intelligent adolescents are more optimistic than those with less intelligence (Nurmi & Pulliainen, 1991). Age may also play a role in determining future optimism although findings are not universal. For example, in their review of the literature, Klaczynski and Fauth (1995) have noted that Nurmi (1989) identified an age-related increase in optimism whereas Verstraeten (1980) and Klaczynski and Reese (1991) reported that age had very little impact on the perceived probability of goal attainment.

Klaczynski and Fauth (1995) examined the influences of intellectual ability, rationality, and intuitiveness as predictors of warranted and unwarranted optimism for future life events in adolescents. They found that most individuals, regardless of their personal qualities, viewed their own futures more positively and more optimistically than the futures of their peers. This was particularly true for relatively more intelligent individuals. Higher inductive ability was associated with less "undesirable event bias" indicating that participants with more ability believed that other students were more likely to experience undesirable events. Three rationality subscales derived from Epstein, Pacini, Denes-Raj, and Heier (1994) were used to analyze cognitive styles and optimistic biases. Analyses showed a significant correlation between desirable event bias and a need for cognition - NFC (e.g. enjoy thinking and taking pleasure from intellectual challenges). Further, the heightened optimism related to NFC and the academic/career desirable bias scores were more prominent among those students in the uppermost range of NFC scores. Klaczynski and Fauth (1995) explained this correlation by suggesting that individuals high in NFC, independent in their abilities, may believe that their passion, involvement, and persistence in intellectual pursuits have either already paid off or will eventually pay off. Students low in NFC, however, evidenced almost no academic/career desirable event bias. None of the other rationality subscales (faith in intuition, head over heart) were significantly correlated with either desirable or undesirable event bias.

The students in Klaczynski and Fauth's (1995) study assessed their own likelihood of experiencing negative life events (e.g. contracting AIDS, getting cancer etc.) to be about 30% on a probability scale, but estimated the perceived likelihood of these negative life events for peers to be greater (50%). These inflated estimates support the availability heuristic and suggest that most adolescents in this study were insensitive to the base rates at which various undesirable events occur by overestimating the probabilities. Klaczynski and Fauth (1995) considered a "personal fable" in which adolescents view themselves as unique and distinct from others in their life circumstances to explain the finding that

adolescents with less intellectual ability believed they were more likely to be successful than their peers (most of whom are more intelligent). Klaczynski and Fauth (1995) concluded that future studies need to explore the relationships between expectations for future life events and adolescents' knowledge of and ability to use base rate information in real-life cost-benefit reasoning tasks.

In another study, Quadrel et al. (1993) compared the degree of optimism and perceived risks among three groups of subjects (adults, their teen children, and high risk teens drawn from group homes specializing in the treatment of chemical abuse problems). Subjects first judged their own probability of experiencing various risks and then the probability of others (friend, acquaintance, parent, a child). Results were consistent with other findings showing small differences for adults and teens in their cognitive decision making processes when estimating their own vulnerability to risk in relation to others (Trad, 1993a, 1993b). Cognitively, the same judgement errors operating in adults may also be operating in adolescents. Interestingly, Quadrel et al. (1993) noted an important difference with the high risk group of teens in their study. Subjects first responded to a quiz about risk behaviours (e.g. factual knowledge questions about alcohol) and then assessed the probability that each response was correct. The adults and low risk teens had similar response patterns and were both moderately overconfident, thus their calibration curves showed small differences. The calibration curves for the high risk group of teens, however, showed they had fewer correct answers, but estimated higher confidence judgments. Are feelings of invulnerability suggesting an optimistic bias (warranted or unwarranted) more pronounced in high risk teens? This was examined in the current investigation by comparing high and low risk adolescents on a future life events inventory.

Decision Making Perspective

An overriding theme from the risk taking literature is the notion of understanding consequences of future actions (Beyth-Marom et al., 1993; Furby & Beyth-Marom, 1992; Lavery & Siegel, 1993; Strathman, Gleicher, Boninger, & Edwards, 1994). While most

of this research has been examined via self-report measures, the current study included a decision making and reasoning task in order to investigate how high and low risk adolescents reason in these two tasks. Specifically, how do adolescents perform when they are presented with tasks in which thinking about the consequences or possible outcomes is the key to successful performance?

A decision making perspective to explain adolescent risk taking behaviour draws on research and observations from two distinct fields of psychology - developmental psychology (Baumrind, 1987) and the psychology of judgement and decision under conditions of uncertainty (Tversky & Kahneman, 1974). Decision models established on normative standards from the adult perspective have been the basis of many intervention programmes to curb risk taking behaviour (Furby & Beyth-Marom, 1992). But normative standards within the psychology of reasoning and decision making are under debate (Stanovich & West, 1998, 2000). Not only are normative standards of rationality under debate (Kyburg, 1983), but criticism of probability models used in statistical reasoning calls into question people's appropriate use of base rates (Birnbaum, 1983) and cost-benefit reasoning in decision making (Larrick, Nisbett, & Morgan, 1993). Stanovich and West (1998, 2000) have reviewed these discourses and concur that investigators need to exercise caution in drawing conclusions about the nature of human thought based on normative standards which are in dispute. They have noted that "on virtually all of the tasks in the heuristics and biases literature, some people do give the normative response" (p.4). How do researchers explain these individual variances? Furby and Beyth-Marom (1992) have emphasized that both normative and descriptive models of decision making behaviour are important to differentiate individual differences.

Formal theory testing in risky choice decision making provides an important foundation for the study of adolescent risk taking (Kahneman & Tversky, 1972, 1984; Slovic et al., 1979, 1986). From a decision making perspective, following an assessment of each possible consequence, a decision maker combines all information according to

some decision rule. Given a person's knowledge and belief about consequence probabilities and values, a widely accepted normative criterion or common rule for making a rational choice is to select the option which has the greatest subjective expected utility (SEU) in order to maximize one's well-being. However, maximizing subjective utility may not be the only appropriate normative decision rule for selecting among various options. Furby and Beyth-Marom (1992) suggested another definition of maximizing well-being: that is, selecting the option with the least probability of resulting in a negative consequence. Lopes (1987) has also offered a variation on the decision making formulation of SEU and suggested that the desire to avoid loss and the desire to exploit an opportunity for gain may also affect risk related decisions. From this perspective, people may take risks not only because the expected value of the possible gain outweighs the expected value of the possible loss, but also because they focus on the potential gain and pay little attention to the potential for loss. Lopes (1993) concluded that risk takers focus on the potential gains of behaviour, while risk avoiders focus on the potential loss. Thus, risk taking during adolescence may serve a variety of functions and a way of achieving goals which may at various points in the life cycle differ from those that adults assume should be important goals for adolescents.

In their review of the literature, Furby and Beyth-Marom (1992) applied a decision making perspective to re-frame the phenomenon of risk taking behaviour by analyzing how adults and adolescents differ in their perceptions of risky behaviours. For example, when making decisions, adolescents may differ from adults in that they consider different options and identify different consequences following each option. As a result, adults may view teen decisions as irrational because they are considering different options and consequences. Further, what adolescents think about the consequences of not engaging in a behaviour may also play a crucial role in determining their respective choices. Adolescents may also give more weight to the probability that drinking could result in their ability to handle alcohol without losing control. Adults, on the other hand, may either fail

to consider this probability or consider it to be zero. While most studies examine the risks of engaging in certain behaviours, for adolescents, not engaging in certain behaviours may also provide risks. Furby and Beyth-Marom (1992) emphasize that adults and adolescents may differ in identifying possible consequences that follow from one or more options being considered by contemplating some valued consequences that the other fails to consider. Thus, a decision making perspective considers risk and consequence perception by re-framing cost-benefit reasoning and base rate information as mechanisms of rational thinking from the perspective of adolescents (Furby & Beyth-Marom, 1992; Parsons, Jeffrey, Siegel, & Cousins, 1997).

Two rational thinking behavioural tasks which simulated real-life decision making were used to further examine whether risk perception in this sample of adolescents was related to performance on the two tasks that involve reasoning about future consequences and statistical reasoning linked to possible gains. The first rational thinking behavioural task was adapted from the one devised by Bechara, Damasio, Damasio and Anderson (1994) and elaborated on by Bechara, Tranel, and Damasio (2000) in their research of patients with damage in the ventromedial prefrontal cortex. This task is a probe to detect sensitivity or insensitivity to future consequences through cost-benefit reasoning via a card game consisting of four decks which delivered monetary rewards and punishments. The second behaviour task tapped the participants' rational and experiential or intuitive processing systems through a game of chance adapted from Denes-Raj and Epstein (1994). This task probed whether participants made nonoptimal, irrational decisions using base rate information by electing to draw from a bowl that they recognized would offer less favourable objective probabilities than an alternative bowl (Denes-Raj & Epstein, 1994).

Together, four different tasks (i.e. perceptions of risk, future-oriented optimism, reasoning tasks, and thinking dispositions) were used to examine the construct of risk taking in a sample of high and low risk adolescents. The risk perception questionnaire and future life events inventory represent current work in the adolescent risk taking literature

while the behavioural reasoning tasks and thinking dispositions questionnaire come from the reasoning and decision making literatures. In addition to coming from separate literatures, these tasks also differ in what they feature and in response requirements: two are self-report measures and two are reasoning or decision making measures. All of these measures were examined in the current study. One logical question that arises is whether these four measures are related. That is, do response tendencies on these different tasks converge to support a "syndrome of problem behaviour?"

Syndrome of Problem Behaviour

Evidence that certain risk behaviours (e.g. substance use/abuse, improper recreational vehicle driving, and unprotected sexual activity) tend to be associated with each other and constitute a syndrome of problem behaviour have been well documented in the literature (Bell & Bell, 1993, Benthin et al., 1993). Although the close association between alcohol use and injuries is well established at all ages, alcohol related motor vehicle injuries have been identified as the leading cause of mortality in late adolescence and early adulthood (Bell & Bell, 1993). Jessor and Jessor (1977) documented the association between early sexual activity and the use of marijuana, cigarettes, and alcohol. Zabin (1984) documented the association of early sexual activity, ineffective contraceptive use, and cigarette use. For females, Zabin (1984) identified the drug of choice for initiation as tobacco in the form of cigarettes; for males, the drug of choice for initiation was alcohol (Zabin, 1984). Beyond the association of substance use with other risk behaviours, Irwin (1993) suggested that substances are associated in predictable ways and that alcohol and/or tobacco appear to be "gateway drugs" for the use of illicit substances.

A theory of problem behaviour posits a psychosocial framework of personality and environmental determinants to explain why risk behaviours tend to be interrelated rather than a collection of independent variables (Jessor, 1984, 1987; Jessor & Jessor, 1977). Jessor et al. (1991) described several "proneness" factors as contributing to problem behaviour: low value on achievement, high value on independence, low expectations for

both achievement and independence, high social criticism, high alienation, low self-esteem, high external control, low attitudinal intolerance of deviance, low moral attitude, and low religiosity. Theoretically, the more strongly this pattern is manifested, the greater the likelihood of engaging in problem behaviour.

Some investigators have focused on the possible mechanisms responsible for the interrelationships of the behaviours (Irwin & Millstein, 1987). Baumrind (1987) asserted that risk taking can often help adolescents build self-confidence, develop tolerance for stress, and learn to take the initiative. Yet Furby and Beyth-Marom (1992) have noted that adolescents are frequently criticized for engaging in certain risky behaviours (e.g. smoking, drinking, taking drugs) while adults are applauded for engaging in other risky behaviours (e.g. mountain climbing, enlisting as a soldier). The concern with adolescents may be the choice of activities rather than the degree of riskiness. For example, Furby and Beyth-Marom (1992) have observed that sexual activity and taking drugs are considered adult behaviours in mainstream North American culture. According to Furby and Beyth-Marom (1992), this may explain the appeal to adolescents and the criticisms directed toward those adolescents who engage in behaviours deemed "risky" for adolescents by adult society and community norms. Thus, differences or similarities between types of risk taking behaviours and decision making processes (e.g. cost-benefit reasoning, base rate information) need to come from the perspective of adolescents (Anderson et al., 1993; Furby & Beyth-Marom, 1992).

A syndrome of problem behaviour presumes that those individuals who engage in some high risk behaviours are more likely to engage in other high risk behaviours. This notion was examined in several ways in the current investigation. First, risk perception and optimistic biases in relation to future life events were examined together. Second, risk perception was examined with performance on the two reasoning tasks. Presumably, those with low risk awareness of the dangers associated with high risk activities would be expected to be less sensitive to perceiving future consequences. This trend was also

expected with the statistical reasoning task. One who is poorly calibrated in a vital domain like risk perception may also be poorly calibrated in real reasoning situations.

Finally, an individual difference perspective was utilized in order to examine risk taking in adolescence. This perspective is based on the work of Baron (1985, 1988, 1993), Stanovich (1992, 2001), and Stanovich and West (1998, 2000). This position helps to answer whether computational limitations can explain low sensitivity to risk and poor reasoning in the sample of adolescents used in this study, or whether other more malleable constructs, such as thinking styles can explain risk perception and reasoning about risk.

Individual Differences in Cognitive Ability, Risk Perception, and Reasoning about Risk

Some research has suggested that adolescents display a tendency toward egocentrism and invulnerability. Some, such as Elkind (1967), have suggested that this tendency is indicative of a cognitive deficiency. Other research has posited that adolescents entertain a personal fable in which they overdifferentiate their thoughts and feelings. Adolescent egocentrism was conceived by Elkind (1967) as a cognitive deficiency in adolescents which occurs when they try to conceptualize the thoughts of others. It is based on Piagetian theory which characterizes egocentrism in childhood as a failure to differentiate between subject and object and a failure to understand where the self ends and where the other begins (Arnett, 1992a, 1992b). In Piaget's formulation, the stage of formal operations begins at age 12-13 and is consolidated by the age of 15-16.

Research is accumulating, however that the attainment of formal operations may not be universal and that adults use this process selectively (Flavell, 1985). Kuhn, Phelps, and Walters (1985) have suggested that since adults are not entirely rational thinkers, the deficiencies of reasoning among adolescents may be even more acute. This is under debate in the literature. Beyth-Marom et al. (1993) found that both adults and adolescents had similar response patterns in their perceived consequences of risk behaviour and concluded that results did not support the claims that adolescents entertain a "personal fable" and

possess feelings of invulnerability. The idea of egocentric thought in adolescents is related to Stanovich and West's (1998, 2000) concept of cognitive decontextualization - the tendency to decouple reasoning operations from the local context and from overlearned situational cues. They conceive decontextualization as a thinking disposition analogous to Piaget's concept of decentration in formal operations. Stanovich and West (1998, 2000) emphasize that "decontextualizing cognitive styles represent one line of defense against overlearned associations that might trigger inappropriate responses" (p.14). From this perspective, the concept of egocentrism may be seen as a cognitive style or personality/thinking disposition.

Lavery et al. (1993) assessed the concept of adolescent egocentrism and the influence of personality variables on risk taking involvement. Their sample consisted of adolescents referred for counselling to community agencies for such reasons as truancy, runaway, delinquency, school failure, depression, family conflicts, and general noncompliance. Three measures were used. The concept of egocentrism was examined using the New Imaginary Audience Scale and the New Personal Fable Scale (NPFS) which explores feelings of personal uniqueness, omnipotence, and invulnerability to future consequences (Lapsley et al., 1989). The Jesness Personality Inventory (Jesness, 1966) was used to assess subjects on such personality characteristics as social maladjustment, personal beliefs, and attitudes. The results were later compared with risk involvement to explore the existence of a syndrome of problem behaviour. To assess a rational decision making theory of risk involvement, Lavery et al. (1993) presented the subjects with a set of 23 risky behaviours which were rated along the dimensions of involvement, risk perception, and benefit perception.

The results of this study supported a decision making perspective and a problem behaviour syndrome, but not a theory of adolescent egocentrism with respect to risk taking. Lavery et al. (1993) found high levels of risk involvement associated with personality factors indicative of social maladjustment. Although perception of risk was negatively

correlated to the Jesness scales, there was a strong positive relationship between the scales and risk involvement. The authors suggested that a failure to perceive risk may be associated with both a higher level of risk involvement and attitudes and beliefs which go counter to social norms. Also, the subjects identified with conduct disorder tended to have higher involvement scores and reported higher perceived benefits of engaging in risk behaviours. The remaining subjects reported less risk involvement, but also assigned less risk to those behaviours in which they reported engaging. According to Lavery et al. (1993), the perceived consequences (i.e. risks and benefits) of risk involvement from the perspective of these adolescents play a role in conceptualizing their decisions to engage in certain risky behaviours. They suggested that adolescent risk taking behaviour should be seen as a multidimensional phenomenon; i.e. different young people engage in different kinds of behaviour for different reasons.

Interestingly, Lavery et al. (1993) did not find egocentrism to be predictive of risk involvement in this sample of adolescents. As well, data from this study showed no significant relationship to either gender or age on the constructs of "imaginary audience" and "personal fable" suggesting that egocentrism in adolescents appears to have no predictive value regarding risk taking in this clinical sample. The data did, however, indicate a significant correlation on the Invulnerability subscale of the New Personal Fable Scale with risk involvement in the subgroup of adolescents identified with conduct disorder. This finding requires further attention by researchers because the idea of adolescent invulnerability is a widely-held belief in our culture and assumes that adolescents take more risks than adults (Bell & Bell, 1993).

A disposition and general tendency to disregard future consequences may prevent a person from feeling vulnerable to risks. The extent to which individuals consider future consequences in making decisions about their current behaviours was the focus of a measure devised by Strathman et al., (1994). Through a series of experiments using seven samples of college students, Strathman et al. (1994) showed evidence that the

Consideration of Future Consequences Scale (CFC) regulates affective responses to negative events with individual differences remaining relatively stable over time. In one experiment, thinking about future consequences when presented with counterfactuals did not ameliorate any negative affect in individuals with low-CFC as it did for those with high-CFC. Thus, individuals with high-CFC may be more likely than those with low-CFC to generate and consider future outcomes even when future consequences are ambiguous or unclear. The CFC Scale has potential for advancing the domain of adolescent risk perception with particular emphasis on weighing immediate and distant outcomes of behaviour. The consideration of future consequences can have significant implications for the choice of behaviour and outcomes which may, in turn, affect the future quality of life of adolescents.

In order to elucidate these complex ideas, an individual difference perspective was used based on the work of Stanovich (1999), Stanovich and West (1998, 2000), and Baron (1985, 1988). These traditions make a strong distinction between cognitive capacities and propensities toward beliefs and actions. Specifically, they call these propensities thinking dispositions or cognitive styles. Importantly, this distinction provides a framework to disentangle whether it is computational limitations or thinking styles that explain what has been termed as egocentrism or feelings of invulnerability in adolescence. Nine thinking dispositions were identified as having the potential for influencing risk taking and risk behaviour perceptions and were used in this study. They were: actively open-minded thinking, counterfactual thinking, paranormal beliefs, impulsiveness, deliberation, ideas (i.e. a need for cognition), a social desirability response, and the consideration of future consequences.

Cognitive Capacities and Thinking Styles

Studies in adolescent risk taking behaviour have suggested that cognitive ability and a personality disposition toward feelings of vulnerability or invulnerability may predispose certain adolescents to cognitive biases in their assessment of risk (Benthin et al., 1993;

Klaczynski & Fauth, 1995; Lapsley, Milstead, Quintana, Flannery, & Buss, 1986; Lavery et al., 1993; Quadrel et al., 1993). General cognitive ability may be one reason that an individual's responses across a variety of risk characteristics, personality dispositions, and rational thinking tasks might be related. Larrick et al. (1993) have argued that intelligent people are more likely than less intelligent people to use cost-benefit reasoning as the most effective reasoning strategies. This assumes, however, that people with more computational power are more likely to utilize these standard normative strategies in producing normative responses on tasks of rational thinking. Stanovich and West (1998, 2000) have noted that this association might also arise for other reasons that serve to validate a normative model (e.g. computational complexity of normative strategy, efficiency and recognizability of strategy). Thus, Stanovich and West (1998, 2000) have posited that if reliable variance in performance on rational thinking tasks exist after differences in computational power are accounted for, such findings could have implications for models of cognitive functioning and rationality. They emphasize that "the residual variance remaining after performance on a rational thinking task is regressed on intelligence could just be chance or it could reflect the influence of some other cognitive propensity - some other skill or disposition or style that is related to performance on tasks of rational thought" (p.10).

Baron (1985, 1988) suggested a generic model of thought adopted by Stanovich and West (1998, 2000) in which cognitive capacities as traditionally measured in I.Q. tests are distinct from personality or thinking dispositions as learned tendencies to behave in certain ways. Capacities usually refer to those cognitive processes termed by Baltes (1987) as the "mechanics of intelligence" that underlie traditional psychometric intelligence testing through such measures as perceptual speed, discrimination accuracy, working memory capacity, and the retrieval of information stored in long term memory. According to Baron (1985) and Stanovich and West (1998, 2000), although cognitive capacities cannot be improved in the short-term by instruction, they can be affected by long-term practice. Both

Baron (1985, 1988) and Stanovich and West (1998, 2000) have observed that by tapping cognitive capacities almost exclusively, psychometric instruments such as I.Q. tests have ignored the potential influences of cognitive styles and thinking dispositions on tasks of reasoning.

In contrast, rational thinking dispositions are cognitive styles which are more malleable and relate to the adequacy of belief formation and decision making (Stanovich & West, 1998, 2000). Some examples of dispositions are the propensity to weigh new evidence against a favoured belief, to persevere on a problem before giving up, and the tendency to weigh heavily others' opinions in forming one's own (Baron, 1985 as cited in Stanovich & West, 1998). In their review of the literature, Stanovich and West (1998, 2000) identified various terms used by other theorists to describe thinking dispositions (e.g. intellectual styles, cognitive emotions, habits of mind, inferential propensities, epistemic motivations, constructive metareasoning, and cognitive styles). They noted that increasing attention is being given to thinking dispositions as "behavioural/cognitive concepts that reside at the borderline of cognitive psychology and personality" (p.11).

Personality or thinking dispositions have theoretical relevance to risk perception. The degree to which people perceive themselves as vulnerable to risk is not always rationally based and is known to be subject to significant cognitive bias (Fischhoff, 1988; Slovic et al. (1979). Two of the more prominent heuristics associated with bias in risk perception are availability or the tendency to estimate the frequency of an event by how easily it is brought to mind (Tversky & Kahneman, 1973, 1974) and representativeness resulting in the tendency of individuals to ignore information on base rates even when people have information about correlates of events (Kahneman & Tversky, 1972, 1984).

Dispositional determinants of rational thinking are also present in cognitive-experiential self-theory (CEST). According to CEST, behaviour is generally guided by the joint operation of two parallel processing systems - rational and experiential (Denes-Raj & Epstein, 1994; Epstein, 1994; Epstein, Lipson, Holstein, & Huh, 1992). Within this

framework, Epstein et al. (1992) have described the experiential system as generally adaptive in natural situations, but maladaptive in unnatural situations that cannot be solved by generalizations from past experience because they require logical analysis and an understanding of abstract relations. Denes-Raj and Epstein (1994) have noted that the greater the emotional involvement, the greater the shift in balance from the rational to the experiential system. Thus, future studies on adolescent risk perception need to broaden the scope of investigation to examine the potential influence of personality or thinking dispositions and rational thinking behaviour on tasks of decision making.

The purpose of this research is to explore whether variations in adolescent risk perception can be associated with cognitive ability, with performance on rational thinking tasks, and with various thinking styles or personality dispositions from the literatures of cognitive and social psychology. Exploring the potential influence of these variables may advance our understanding of how different subgroups of the adolescent population think about risk and make rational choices and decisions about certain behaviours which may have future negative outcomes. This investigation assumes as its framework a generic model of human thought suggested by Baron (1985, 1988) and adapted by Stanovich and West (1998, 2000) which distinguishes between cognitive capacities (as traditionally measured on I.Q. tests) and personality or thinking dispositions (as learned tendencies to behave in certain ways). This model has relevance to the study of adolescent risk perception because the degree to which people assess risk or perceive themselves as vulnerable to risk is not always rationally determined (Denes-Raj & Epstein, 1994; Fischhoff, 1988; Johnson & Tversky, 1984; Slovic, 1987; Slovic et al., 1979).

Research Questions and Hypotheses

This research study was exploratory in nature. The investigation examined the variables of cognitive ability, personality/thinking dispositions, and mechanisms of rational thinking as potential influences of risk taking and risk behaviour perception in two different subgroups of the adolescent population. Two groups of adolescents were compared on

several related tasks and measures - an identified group of male adolescents with behaviour problems which were manifested through multiple school suspensions (i.e. high risk group) and a non-identified group of male adolescents with low level school suspensions (i.e. low risk group). Specifically, this investigation explored the following research questions:

1. Do adolescents identified with behaviour problems (i.e. high risk group) differ from their non-identified peers (i.e. low risk group) on self-reported risk involvement, risk behaviour perceptions, expectations of future life events, or mechanisms of rational thinking behaviour?
2. Do intercorrelations exist among the tasks used within the two groups of adolescents to support a syndrome of problem behaviour?
3. Can performance on the different risk related measures be explained by individual difference measures, specifically cognitive ability and thinking styles?

Chapter II

Method

Participants

The participants in this investigation were a convenience sample of 90 male students attending an inner city secondary school in a large metropolitan area of Canada and who volunteered to participate in the study. Their mean age was 16.2 years ($SD = 1.7$). The secondary school had a total population of 950 students and served a diverse community, with the most prominent cultural backgrounds being Portuguese, Spanish, and Italian. Given that many behaviour items and activities in risk taking studies tend to reflect a male gender stereotype (Furby & Beyth-Marom, 1992), only male adolescents were selected for participation in this investigation. To ensure a homogenous sample and to minimize any cultural stress factors, only male students who were born in Canada and who came from homes in which English was a primary language were included in this sample.

Two subgroups of the total student population of approximately 475 males were compared in this investigation. The first subgroup consisted of students identified by school personnel as engaging in problem behaviours based on the criterion of two or more suspensions from school during the first semester (i.e. 5 months) of the current school year. This group was termed the High Suspension Students (HSS) or the "high risk" group. The second subgroup consisted of students who had received at most one suspension during the first semester (i.e. 5 months) of the current school year. This subgroup formed the Low Suspension Students (LSS) or the "low risk" group in the investigation. The reason for including students with only one suspension in the LSS group is based on the rationale that students with only a single suspension were very similar to students with no suspensions (Ellis & Geller, 1993).

The criterion of engaging in problem behaviour resulting in one or more suspensions from school was used as the salient feature of partition for the two subgroups of students for two reasons. First, problem behaviours identified by Ellis and Geller

(1993) as those most frequently resulting in school suspensions are also behaviours and activities most often reflected in risk taking studies. These same problem behaviours are not limited to adolescence, but can also be found in adults. Second, the criterion for partitioning tended to eliminate any value judgments on the seriousness of behaviour problems resulting in suspension or on the students' history of engaging in problem behaviours which may or may not have resulted in school suspension(s).

The selection process of participants took place at the end of the first semester or the first 5 months of school. In order to oversample students with suspension records, the investigator attempted to identify 50 students who had experienced suspensions by interviewing school personnel (administration, guidance counsellors, attendance secretary). A verification of school records succeeded in identifying 49 male students who had experienced suspensions during the first 5 months of school (i.e. 10% of the male student population). Following interviews of informed consent, 45 of these students who had experienced suspensions during the first 5 months of school and who met other criteria (e.g. born in Canada) volunteered to participate in this investigation. From the sample of 45 volunteers, 18 students had experienced one suspension and 27 students had experienced multiple school suspensions (i.e. two or more suspensions). The latter group of 27 students formed the HSS group in this investigation and represented approximately 5% of the total number of male students who had experienced 2 or more suspensions during the first 5 months of school. Forty-five additional male students matched in age (i.e. by year, month, day of birth) were recruited and their records were verified to ensure that they had experienced no suspensions. This group of 45 students plus the 18 students who had experienced only one suspension formed the LSS group of 63 students in this investigation.

In the HSS group, 16 students had experienced two suspensions and 11 students had experienced more than two suspensions. The suspensions were for a variety of reasons including: destroying property (e.g. graffiti, vandalism), fighting, stealing, cutting

class/school, threatening others, using a prohibited substance (e.g. alcohol, drugs), smoking, using foul language, excessive lates, and opposition to authority. The most common categories of suspension were fighting (17), smoking (17), skipping school (15), and destroying property (10).

The mean age of the 27 students in the HSS group was 16.5 (SD = 1.6) and the mean age of the 63 students in the LSS group was 16.0 (SD = 1.7). Parental education was indicated on a demographics sheet that the students filled out. The mean years of education for mothers of the HSS group was 12.1 (SD = 2.0). For mothers of the LSS group, the mean years of education was 11.2 (SD = 1.7). The mean years of education for fathers of the HSS group was 11.4 (SD = 1.9). For fathers of the LSS group, the mean years of education was 11.2 (SD = 2.3). Overall, parental socio-economic status (i.e. SES) was not significantly different across the HSS and LSS groups of students.

Data analysis identified some outliers as missing data. For example, analyses identified six participants who did not appear to discriminate their responses on the knowledge of risks or dangers associated with the six secondary risk activities. Thus, mean responses of 3 or <3 were removed from six participants on this subscale and treated as missing data. Analyses also identified one participant who did not appear to discriminate his responses on the fear of possible risks or dangers associated with the six secondary risk activities. Thus, mean responses for this one participant were removed on this subscale only and treated as missing data.

Tasks and Measures

Risk Perception Questionnaire

Risk Behaviours and Activities. The risk perception questionnaire in this investigation was modelled on a perception questionnaire devised by Benthin et al. (1993) and influenced by a review of other studies on adolescent risk taking behaviour (Beyth-Marom et al., 1993; Furby & Beyth-Marom, 1992; Lavery et al., 1993). See Appendix A for behaviour activities and perception subscales. Participants made quantitative

judgements for 17 risk behaviours and activities considered to represent problem behaviours during adolescence. Items were selected from those used in a variety of studies on adolescent risk taking behaviour according to the criteria of prevalence, popularity, and presumed importance from a risk standpoint (Benthin et al, 1993; Beyth-Marom et al. 1993; Lavery et al, 1993; Quadrel et al, 1993). Eleven primary risk behaviour items and activities included those considered to represent a primary risk to an individual's well-being (e.g. drinking, getting drunk, smoking cigarettes, using marijuana, taking drugs, riding with a drunk driver, riding/driving without a seatbelt, having unprotected sex, shoplifting/stealing, fighting, damaging property/vandalism). Six secondary risk behaviour items and activities included those considered to represent socially approved activities that have elements of risk (e.g. riding a bicycle, swimming, playing contact sports, using skateboard/rollerblades, cutting class/school, riding a motorcycle).

Participants first indicated their level of involvement in each of the 17 behaviour items during the previous 6 months by checking one of four frequency categories (1-none, 2-once or twice, 3-three to 5 times, 4-more than 5 times). Their perceived participation of peers was also measured. Participants estimated the level of peer involvement in each behaviour item during the previous 6 months by checking one of four frequency categories (1-none, 2-once or twice, 3-three to 5 times, 4-more than 5 times). Total scores were obtained for each behaviour item by summing the frequency ratings, followed by the calculation of means for each behaviour item across both primary and secondary activities.

Risk Perception Subscales. Participants rated each of the 17 behaviour items on nine risk characteristics using risk perception scales. These risk characteristics were selected because of their importance in previous studies of risk perception and because of their potential relevance to adolescent behaviour (Benthin et al., 1993). All 17 behaviour items were rated by participants using a response format consisting of a seven point scale for each risk characteristic (e.g. Do you fear the possible risks or dangers of this activity? 1=not at all7= great deal of fear). Participants rated one risk characteristic before the

next characteristic was considered. Examples of risk characteristics are: knowledge of risks, fear of potential risks, personal risk, risk to peers, personal control of risks, avoidance of risks, influence of peers, benefits versus risks, and perceived risk for not engaging in the behaviour or activity. Total scores for each perception subscale across each of the 17 behaviour items were obtained first, then means for each of the nine subscales were calculated for both primary activities and for secondary activities.

Two composite variables for risk perception were constructed for the purpose of analysis. A composite of risk perception for primary activities was constructed by first summing the means of the following subscales to create set one: knowledge, avoidance, fear, risk to others, and risk to self. The sum of means from the following subscales for primary activities created set two: control, influence of peers, benefits greater than risks, and not doing-negative consequences (i.e. perceived risk for not engaging in activity). Then, set one minus set two resulted in a composite of risk perception for primary activities. A similar process was followed to create a composite of risk perception for secondary activities. A composite of risk involvement was created by summing the means of self-reported involvement in primary and secondary activities and a composite of peer involvement was created by summing the means of perceived peer involvement in primary and secondary risk activities.

In addition, three overall composites were created from the risk perception questionnaire for analysis in Table 7 (see page 64). An overall composite of risk perception was derived by combining the composites of primary risk perception and secondary risk perception. An overall composite of risk involvement was created by combining the participants' means of self-reported involvement in both primary and secondary risk activities. Peer involvement is another overall composite variable derived by summing the participants' means on their perceptions of peer involvement in both primary and secondary activities. The rationale for creating these overall composites is based on data results from a previous analysis in Table 6 (see page 62) which found that

the composite variables of risk perception for primary and secondary, and the reported means of risk involvement and peer involvement for both primary and secondary activities were positively correlated with their corresponding variables.

Future Life Events Inventory

Klaczynski and Fauth (1995) modified Weinstein's (1980) original life events inventory to reflect issues and content domains from adolescent self-reports of future expectations. According to Klaczynski and Fauth (1995), since many of the undesirable events included in their inventory are frequently discussed in the media (e.g. AIDS, divorce rates), they are likely to involve participants' knowledge of base rate information and their use of the availability heuristic. The participants in Klaczynski and Fauth's (1995) study were adolescents attending college. This investigation further adapted those events in Klaczynski and Fauth's study (1995) and incorporated some items from Jessor et al. (1975) to reflect events that are more relevant to adolescents attending secondary school (see Appendix B).

The life events inventory in this investigation included a total of 23 future life events (10 desirable and 13 undesirable events). Examples of desirable events are: graduating from high school, getting your driver's licence before leaving high school, having good enough grades to attend university/college if you want to, having a steady boyfriend/girlfriend for more than 4 weeks, getting on the honour roll this year, being one of the most popular kids in your class, getting a good job with a high salary after graduating, winning an award or being recognized for an accomplishment by your school, being thought of as a best friend by several kids in school, enjoying your first job after graduating. Examples of undesirable events are: getting divorced, not finding a job within six months of graduating, being fired from a job, dropping out of high school, being arrested, contracting AIDS, developing cancer, being laid off from a job, contracting a venereal disease, being injured in an auto accident, requiring treatment for a drug or alcohol problem, having a house in which you live burn down.

Participants first compared themselves with other students of the same sex at their school (FLS-Future Life Events for Self) to estimate their chances that each event will happen to them on a straight probability scale ranging from (0% to 100%). Thus, for each event, participants estimated the probability that they would experience that event resulting in "self desirable" and "self undesirable" scores. Next, participants estimated the probability (again on a scale of 0% to 100%) that other students at their school (FLO-Future Life Events for Others) would experience the events resulting in "other desirable" and "other undesirable" scores. Probability ratings were obtained by summing the percentage values assigned to each of the 23 life events (both desirable and undesirable) for oneself and for others, followed by a calculation of means for positive and for negative future life events for both oneself and for others. The participants' degree of optimism for positive life events was then determined by subtracting the mean of positive life events for others from the mean of positive life events for oneself.

The Gambling Task of Cost-benefit Reasoning

Two tasks were selected from the cognitive psychology literature to explore cost-benefit reasoning and using base rate information as mechanisms of decision making in the form of games. The first behaviour task explored the participants' sensitivity/insensitivity to future consequences using cost-benefit reasoning as a mechanism of rational thinking. The gambling task was an adaptation of a card game originally devised by Bechara et al. (1994) as a probe to detect cognitive mechanisms responsible for the development of impairments in real-life decision making for individuals who otherwise have normal intellectual functions. In this study, it is termed the gambling task. This gambling task of cost-benefit reasoning was selected for this investigation because the card game simulated in real time, personal real-life decision making relative to the way it factored uncertainty of premises and outcomes as well as reward and punishment (Bechara et al., 1994). The gambling game was individually administered.

Materials. The materials required for playing this game consisted of: four decks of researcher designed playing cards, 120 \$1.00 coins (i.e.\$120.00) of real money in a container, 400 \$0.25 coins (i.e. \$100.00) of real money in a container, a hand counter (e.g. golf counter) to track the number of trials during the game, and researcher designed score cards to record the participants' sequence of card selections following the game (see Appendix C for score card). Each deck was constructed using blank white index cards measuring 3 X 5 inches. All cards were equal in appearance (i.e. size, shape, thickness, texture, pattern). There were a total of 60 cards in each of the four decks (i.e. 50 play cards followed by 10 "bogus" cards).

The first 50 cards in each deck were each labelled using the same font and font size as belonging to one of the four decks (i.e. A, B, C, or D). The names of the decks were placed evenly on the back and centre of the cards. On the other side (i.e. right side) of the first 50 play cards in each deck, both the monetary rewards and monetary penalties (if any) associated with that card selection were clearly labelled in the centre of the cards using the same font and font size (e.g. Reward \$1.00, or Reward \$0.50, or Reward \$1.00 / Penalty \$2.00, or Reward \$1.00 / Penalty \$12.50, or Reward \$0.50 / Penalty \$0.25, or Reward \$0.50 / Penalty \$2.50 etc.). The amount of the penalty varied with both the deck and the position of the card in the deck according to a pre-determined schedule not known to the participants. See the score card in Appendix C for schedule of penalties.

Cards in each deck were also numbered from 1-50 (at the top right corner on the right side of cards) using a small unobtrusive font size. The numbering of the playing cards from 1-50 facilitated the experimenter's re-shuffling of cards to their proper sequence before playing the game with the next participant.

Ten "bogus" cards followed the 50 play cards in each deck. They functioned as a reminder to participants that card selections from a particular deck were exhausted. The back of each "bogus" card (i.e. cards number 51-60) in each of the four decks were labelled, "This deck is finished. Select another."

At the end of each game and prior to beginning the game with the next participant, the experimenter examined all cards for possible damage during play (e.g. bending, creasing) and replaced cards or entire decks as necessary. These precautions were taken to minimize the possibility of card selections based on any visual or tactile cues.

Playing the Game. The experimenter sat beside each participant at a table in an empty and quiet room to assure privacy. This seating arrangement minimized the possibility of card selections based on any physical or facial cues inadvertently communicated by the experimenter. The four decks of cards were presented horizontally on the table in sequential order (i.e. A, B, C, D).

Each participant was given a \$20.00 loan of real money (i.e. ten \$1.00 coins and forty \$0.25 coins totalling \$20.00) and instructed on how to play the game. They were given the following instructions:

- 1) that the game required a series of 100 card selections (one card at a time) from any of the four decks;
- 2) that the goal of the task was to maximize profit on the loan of money;
- 3) that cards had rewards and possible penalties
- 4) that they were free to switch from any deck to another, at any time, and as often as they wished until they reached a total of 100 card selections.

To increase the realism of the task, participants were also told that they would be staked for \$20.00. That is, at the end of the game, participants were expected to return the original \$20.00 loan. However, if participants had a net gain, they could keep any amount of money over the original \$20.00 loan. Participants were also assured, however, that they would not be held accountable for any net losses accrued by the end of the game.

Participants were Not told:

- 1) that each deck contained a total of 60 cards (i.e. 50 play cards followed by 10 "bogus" cards);
- 2) that every card in decks A and B yielded a monetary reward of \$1.00;

3) that every card in decks C and D yielded a monetary reward of \$0.50;

4) that some cards in each of the four decks (in addition to a monetary reward) also yielded a monetary penalty according to a pre-determined schedule (see score card).

Precautions were taken throughout the game by the experimenter to ensure that communications with participants were limited to the rules of the game, delivered in a neutral tone with flat affect, and were non-contingent upon the selection of cards.

After turning any card from any deck, participants were either given money and instructed to proceed with the next selection OR were given money and asked to pay a penalty before proceeding with the next selection. Participants placed selected cards on the table in a single pile and right side up so that they had a visual reminder of the consequences (i.e reward/penalty) from their last card selection.

The experimenter tracked the number of card selections (up to 100) using a hand/golf counter. At any point during the game, participants could request the number of remaining card selections. If participants exhausted a deck and inadvertently selected a "bogus" card, the experimenter simply stated, "Please select another."

Turning any card from either deck A or deck B yielded \$1.00 for each selection. However, decks A and B were disadvantageous in the long run because these decks also had higher penalty amounts. For example, after turning 10 cards from either decks A or B, participants had earned \$10.00. However, participants had also encountered 5 unpredicted penalties totalling \$12.50 and incurred a net loss of \$2.50. This was the same for deck B. Both decks A and B were equivalent in terms of overall net loss over trials. The difference between the decks was that in deck A, the penalty was more frequent, but of a smaller magnitude (e.g. \$1.50, \$2.00, \$2.50, \$3.00, \$3.50). In deck B, the penalty was less frequent, but of a higher magnitude (\$12.50).

Turning any card from either deck C or deck D yielded \$0.50. Decks C and D were advantageous in the long run because card selections from these decks resulted in an overall net gain. For example, after turning 10 cards from either decks C or D, although

participants had earned only \$5.00, the total of unpredicted penalties was only \$2.50. As a result, participants netted \$2.50. Decks C and D were also equivalent in terms of overall net loss. The difference in these two decks was that in deck C, the penalty was more frequent and of a smaller magnitude (e.g. \$0.25, \$0.50, \$0.75), while in deck D, the penalty was less frequent, but of a higher magnitude (\$2.50). The ultimate future yield of each deck varied because the penalty amounts were higher in the high-paying decks (A and B) and lower in the low-paying decks (C and D).

Data Collection. The accumulation of the 100 card selections for each participant comprised the task's data collection. Following the game, the experimenter made observational notes on the session and transferred each participant's sequential order of card selections (from 1-100) onto individual score cards. The score cards were modelled on those used by Bechara et al. (1994). They were designed in 5 blocks of 10 response options for each of the four decks. The pre-determined schedule of penalties was outlined on the score cards.

The net gain or net loss (in dollars) for each participant was scored (total \$ earnings). The score card provided data on the participants' response patterns (e.g. number of transitions from decks A and B to decks C and D, number of trials taken before returning to the same deck after a penalty in that deck etc.). The following variables were examined: number of choices from each of the four decks of cards over 100 draws and over the last 50 draws; number of choices from the combined advantageous decks (C + D) and the combined disadvantageous decks (A + B) over 100 draws and over the last 50 draws; \$ rewards and \$ penalties for each deck; total \$ penalties and total \$ earnings above the stake.

The Marble Task of Base Rate Reasoning

The second behaviour task tapped the participants' rational and experiential or intuitive processing systems through a game of chance adapted from Denes-Raj and Epstein (1994). This task probed whether participants made nonoptimal, irrational decisions using

base rate information by electing to draw from a bowl that they recognized would offer less favourable objective probabilities than an alternative bowl (Denes-Raj & Epstein, 1994). In this study, it is termed the marble task. Following is a description of materials and procedures for playing the game.

Materials. The materials required for playing this game of chance consisted of: various mixtures of black and white marbles, two large transparent bowls (equal in size and appearance), two small transparent bowls (equal in size and appearance), twenty \$1.00 coins totalling \$20.00, a table divider to shield the selected bowl from view, and score cards to record the participants' selection of bowls for each trial. Transparent bowls were used to allow participants a full view of all marbles. Precautions were taken to ensure that all marbles were uniform in appearance (e.g. size, shape, texture, colour) to minimize the possibility of selections based on any visual or tactile cues.

Playing the Game. The experimenter sat beside each participant at a table in an empty and quiet room to assure privacy. This seating arrangement minimized the possibility of selections based on any physical or facial cues inadvertently communicated by the experimenter. Participants were told that the concern of the task was to understand people's preferences in drawing from two bowls of marbles under various conditions.

Participants were each given a \$5.00 loan of money and instructed on how to play the game. They were told:

- 1) that the task was a game of chance in which they could make some money;
- 2) that they had the option of drawing from one of two bowls which contained a different number of marbles;
- 3) that there were a total of 12 trials (i.e. 5 win trials, 5 lose trials, and 2 win trials);
- 4) that they could win \$1 if they drew a black marble on a win trial, but lose \$1 if they drew a black marble on a lose trial.

To increase the realism of the task, participants were staked for \$5.00. They were told that at the end of the game, they were to return the original \$5.00 loan, but could keep

any earnings beyond the original \$5.00 loan. Participants were assured that they would not be held accountable for any net losses. They were also assured that there was no deception in the game and that the amount of money they could win or lose was in accordance with the stated probabilities on each bowl.

There were a total of 12 trials in this game of chance (i.e. 5 win trials, 5 lose trials, and 2 win trials). The ratio of black:white marbles depended on the trial. On the first 10 trials (i.e. 5 win trials and 5 lose trials), the small bowl always contained 10 marbles (1 black, 9 white) and the large bowl always contained 100 marbles (9 black, 91 white).

The first 5 trials were designated as win trials and participants could win \$1.00 if they drew a black marble, but nothing if they drew a white marble. Thus, on win trials, the small bowl offered participants only a 10% chance of winning \$1.00 by drawing a black marble while the large bowl offered them a 9% chance of winning \$1.00 by drawing a black marble.

The next 5 trials were designated as lose trials and participants could lose \$1.00 if they drew a black marble, but nothing if they drew a white marble. Thus, on lose trials, the small bowl offered participants only a 10% chance of losing \$1.00 by drawing a black marble while the large bowl offered them a 90% chance of losing \$1.00 by drawing a black marble.

The last two trials were designated as win trials to sustain morale in this game of chance (Denes-Raj & Epstein, 1994). Although the total number of marbles in each of the small and large bowls were the same as in previous trials, the ratio of black:white marbles were different. On these trials, the chance that participants could win \$1.00 increased because the small bowl contained 5 black and 5 white marbles (offering a 50% chance of drawing a black marble) while the large bowl contained 45 black and 55 white marbles (offering a 45% chance of drawing a black marble).

On each trial, the experimenter presented a pair of bowls (one small, one large) with various mixtures of black and white marbles depending on the trial. The bowls were

placed beside one another on the table in front of the participant. To eliminate concern about arithmetic ability, an index card was placed in front of each bowl with information on the percentage of black marbles that each bowl contained and the respective probabilities of selecting a black marble from each bowl (Denes-Raj & Epstein, 1994).

The experimenter named the trial number, announced whether the trial was a win or lose trial, called attention to bowls by pointing to them, and read the information on the index cards which described the respective probabilities for each bowl. For example, on a win trial, the experimenter stated, "The small bowl offers a 10% chance of drawing a black marble. There is 1 chance out of 10 of drawing a black marble from the small bowl. (pause) The large bowl offers a 9% chance of drawing a black marble. There are 9 chances out of 100 of drawing a black marble from the large bowl."

Following the experimenter's description of probabilities, participants were requested to select one of two bowls from which they wished to draw a marble. The participant's choice of bowl (i.e. small or large) was recorded by the experimenter on a score card. The experimenter then shielded the selected bowl from view (behind the divider), set the other bowl aside (out of view), scrambled the marbles in the selected bowl, and told participants to reach over the divider to draw a single marble from the bowl of their choice (which was shielded from view).

If participants selected a black marble on a win trial, they were immediately given \$1.00. If, however, they picked a black marble on a lose trial, they paid \$1.00 to the experimenter. This was also recorded on a score card. At the end of the game, participants returned the original loan of \$5.00 and kept any net gains. They were not held accountable for any net losses.

Data Collection. Following the game, the experimenter made observational notes on the sessions. Score cards were designed to record the following information for each participant: number and type of trial (win/lose trials), choice of bowl (small/large), colour of marbles drawn from the bowl (black/white), monetary gain/loss for each win/lose trials,

and the final net gain/loss. The following variables were examined: rational choice of bowl offering the best probability (over 12 trials); rational choice of marble from bowl offering the best probability (over 12 trials); rational choices over 5 win, 5 lose, and 2 additional win trials; total rational choices; total \$ earnings above the stake.

Thinking Dispositions Questionnaire

Participants completed a questionnaire consisting of nine subscales which measured thinking dispositions. The dispositions selected for investigation in this study represent thinking styles which were expected to be related to risk perception and risk taking behaviour. These thinking dispositions are distinct from cognitive ability. The response format for each item in the thinking dispositions questionnaire was: 1-Disagree Strongly, 2-Disagree Moderately, 3-Disagree Slightly, 4-Agree Slightly, 5-Agree Moderately, 6-Agree Strongly. Some items in the subscales were reverse scored (see Appendix D for details). Following is a description of these scales and the rationale for their inclusion in this investigation. A total score for each thinking disposition subscale was calculated by summing the ratings on all items within each subscale.

Spearman-Brown reliabilities were performed on seven subscales of the thinking dispositions questionnaire, including: actively open-minded thinking, paranormal beliefs, impulsiveness (NEO Scale N5), deliberation (NEO Scale C6), ideas (NEO Taxonomy Scale 05), consideration of future consequences, and the New Personal Fable scale. The Spearman-Brown procedure was used as according to Anastasi and Urbini (1997), the Spearman-Brown formula is widely used in determining reliability by the split-half method, especially in relation to a single administration of one form of a test. Two thinking disposition subscales were omitted from this procedure because they consisted of five or fewer items. Reliability coefficients are reported for the seven thinking disposition subscales.

Actively Open-Minded Thinking Scale (AOT). The actively open-minded thinking Scale (AOT) was devised by Stanovich and West (1998, 2000) and specifically influenced

by the work of Baron (1985, 1988, 1993) and the critical thinking literature. According to Stanovich and West (1998, 2000), Baron (1985, 1988, 1993) has emphasized the concept of actively open-minded thinking "through the cultivation of reflectiveness rather than impulsivity, the seeking and processing of information that disconfirms one's belief (as opposed to confirmation bias in evidence seeking), and the willingness to change one's beliefs in the face of contradictory evidence" (Stanovich & West, 1998, 2000). Exploring a disposition toward actively open-minded thinking has relevance to this investigation. Studies have found that certain subgroups of the adolescent population (i.e. high risk teens, teens identified with conduct disorders, and teens with low intelligence) tend to underestimate their own risk relative to that faced by others when judging the probability of adverse outcomes suggesting a confirmation bias (Benthin et al., 1993; Klaczynski & Fauth, 1995; Lavery et al., 1993; Quadrel et al., 1993). It was therefore expected that low scores on the AOT scale would be associated with low risk perception and low performance on the reasoning tasks.

The AOT consisted of ten items. Sample items include: "If I think longer about a problem, I will be more likely to solve it"; "Considering too many different opinions often leads to bad decisions" etc. A Spearman-Brown reliability coefficient of 0.63 was obtained on the actively open-minded thinking subscale.

Counterfactual Thinking Scale (CounterF). Counterfactual thinking taps the concept of decontextualizing thought described by Stanovich and West (1998, 2000) as the tendency to decouple reasoning operations from the local context and from overlearned situational cues. Thus, when correlated with other potential influences, a measure of counterfactual thinking may provide insight into how adolescents think about risk and make choices about certain risky behaviours which may have negative future consequences.

A subscale of counterfactual thinking taken from Baron (1985, 1988) and used by Stanovich and West (1998, 2000) was included in this study. There were two items in this subscale: "My beliefs would not have been very different if I had been raised by a different

set of parents"; and "Even if my environment (family, neighbourhood, schools) had been different, I probably would have the same religious views." Reliability testing was not performed on the counterfactual thinking subscale because it consisted of only two items.

Paranormal Beliefs (Para). Jessor et al. (1991) identified a high belief in external control as a proneness factor contributing to problem behaviour in adolescents. A paranormal beliefs subscale is included to explore the possible associations of this thinking disposition with other variables in risk assessment (e.g. biased optimism, cost-benefit reasoning, base rate information). This subscale was composed of six items. Sample items include: "It is advisable to consult your horoscope daily"; "Astrology can be useful in making personality judgments" (adapted from Jones, Russell, & Nickel, 1977). Other examples are: "The number 13 is unlucky"; "It is bad luck to have a black cat cross your path" etc. These items are similar to the superstition subscale of a paranormal beliefs questionnaire developed by Tobacyk and Milford (1983) and used by Stanovich and West (1998, 2000). A Spearman-Brown reliability coefficient of 0.81 was obtained on the paranormal beliefs subscale.

NEO Scale N5: Impulsiveness Subscale (Impulse). Some investigators have identified sensation seeking and impulsivity as prominent factors contributing to a variety of problem behaviours in adolescence (Arnett, 1992a, 1992b; Zuckerman, 1979a; Zuckerman & Neeb, 1980). Given that Baron (1985, 1988, 1993) emphasizes the cultivation of reflectiveness rather than impulsivity in being actively open-minded, a disposition toward impulsivity may have possible associations with making risky choices and decisions. This study uses an eight item subscale of the NEO scales from Costa and McCrae (1992) to specifically tap a disposition toward impulsive behaviour. Sample items include: "I rarely overindulge in anything" (reverse scored); "I have trouble resisting my cravings" etc. A Spearman-Brown reliability coefficient of 0.03 was obtained on the impulsiveness subscale which suggests that this construct has poor internal consistency and likely poor explanatory power.

NEO Scale C6: Deliberation (Delib). The degree to which one deliberates and considers the possible outcomes of engaging in certain behaviours and activities may have associations with risk perception and decision making (Furby & Beyth-Marom, 1992). This study used an eight item subscale of the Revised NEO Personality Inventory (Costa & McCrae, 1992) to specifically tap the participants' tendency toward deliberation as a thinking disposition. Sample items include: "Over the years, I've done some pretty stupid things" and "I think things through before coming to a decision" etc. A Spearman-Brown reliability coefficient of 0.63 was obtained on the deliberation subscale.

NEO Taxonomy Scale 05: Ideas (OIdeas). Klaczynski and Fauth (1995) found a significant correlation between an optimistic bias for desirable events and a high need for cognition. Thus, an 8 item subscale of the Revised NEO Personality Inventory (Costa & McCrae, 1992) was administered to tap a propensity toward ideas which reflect cognitive interests. The items on this subscale include: "I often enjoy playing with theories or abstract ideas"; "I find philosophical arguments boring" and "I enjoy solving problems or puzzles" etc. A Spearman-Brown reliability coefficient of 0.36 was obtained on the ideas subscale.

Social Desirability Response Bias (SDesire). A measure of social desirability as a response bias is included for two reasons. First, Lavery et al. (1993) have suggested that high levels of risk involvement and a failure to perceive risk may be associated with attitudes and beliefs which go counter to social norms. Second, Jessor et al. (1991) have identified a proneness factor of high social criticism as a personality determinant contributing to a pattern of problem behaviour. Five items reflecting social desirability as a response bias are taken from Erwin's (1981, 1983) Scale of Intellectual Development (SID) and used by Stanovich and West (1998, 2000). Sample items include: "I always put forth my best effort" and "I am always trustworthy and truthful" etc. Reliability testing was not performed on the social desirability subscale because it consisted of only five items.

Consideration of Future Consequences (CFC). Judging the desirability and perceived riskiness of consequences may impact on the choice of decisions (Furby & Beyth-Marom, 1992) and a general tendency to disregard future negative outcomes may prevent a person from feeling vulnerable to risks (Strathman et al., 1994). Thus, the Consideration of Future Consequences Scale (CFC) devised by Strathman et al. (1994) was included as a subscale of the thinking dispositions questionnaire to tap how adolescents think about considering the future consequences in making decisions about their current behaviours. According to Strathman et al. (1994), the CFC scale represents a construct hypothesized to be a stable individual difference in the extent to which people consider distant versus immediate consequences of potential behaviour. The original response format of the CFC scale (1-extremely uncharacteristic of me to 5-extremely characteristic of me) was modified in this study to ensure consistency with the response format of the other subscales in the thinking dispositions questionnaire (1-disagree strongly to 6-agree strongly). The sentence structures and language of the original CFC statements were also modified.

The CFC subscale consists of 11 statements. They include: "I think about the future and try to influence it with my day to day behaviour" and "I often do things to achieve outcomes (goals) that may not happen for many years" etc. A Spearman-Brown reliability coefficient of 0.74 was obtained on the consideration of future consequences subscale.

New Personal Fable Scale (NPFS). Based on a review of the literature, entertaining a "personal fable" of uniqueness, omnipotence, and invulnerability continues to emerge as a possible explanation for risk involvement and risk perception in certain subgroups of the adolescent population. Researchers have suggested that a "personal fable" may explain a disposition toward feelings of invulnerability in high risk teens (Quadrel et al., 1993) and for teens identified with conduct disorders (Lavery et al., 1993). Others have suggested that a "personal fable" may contribute to a syndrome of problem

behaviour (Benthin et al., 1993) and unrealistic optimism for future life events in less intelligent adolescents (Klaczynski & Fauth, 1995).

The New Personal Fable Scale (NPFS) was originally devised as a 46 forced-choice (true, false) measure to assess feelings of personal uniqueness, omnipotence, and vulnerability (Lapsley et al., 1989; Lavery et al., 1993). The study will assess these three aspects of a "personal fable" and explore their possible association with other variables in the investigation. The original response format of the NPFS (true/false, forced-choice) was modified to ensure consistency with the response format of the other subscales in the thinking dispositions questionnaire (1-disagree strongly to 6-agree strongly).

Eleven items from the NPFS were selected to assess a disposition toward entertaining a personal fable by tapping feelings of personal uniqueness, omnipotence, and invulnerability. Sample items include: "No one has the same thoughts and feelings that I have"; "I believe that no one can stop me if I really want to do something"; "I am not afraid to do dangerous things"; etc. A Spearman-Brown reliability coefficient of 0.79 was obtained on the New Personal Fable scale.

Cognitive Ability Measures

The participants' general cognitive ability was measured using four subtests from the Canadian Cognitive Abilities Test (CCAT), Multilevel Edition, Form 7, Level F difficulty (Thorndike & Hagen, 1989). The CCAT level of difficulty (i.e. Level F-grade 10) was determined based on the average grade level of participants in the LSS group. The four subtests used from the CCAT were: the sentence completion test of the verbal battery (25 items) and figure classification (25 items), figure analogies (25 items), and figure analysis (15 items) tests of the nonverbal battery. Total raw scores (with no corrections for age) on each of the four subtests were the variables used for group comparison. A composite cognitive ability score was derived by summing the standardized scores on the four subtests. Following is a brief description of the subtests used in this investigation.

Sentence Completion Test (SenCompletion). The sentence completion test of the verbal battery of the CCAT was selected to provide a measure of the students' inductive reasoning and verbal abstract reasoning. Thorndike and Hagen (1989) point out that all tests in the verbal battery of the CCAT require individuals to use verbal concepts acquired from experience both in and out of school to solve a verbal task which has not been taught in school. The items require individuals to abstract the common element among three of four verbal stimuli and then to select the word that goes with them.

The sentence completion test of the verbal battery of the CCAT consisted of 25 items. The items on the test require students to comprehend the thought or idea expressed in a sentence and then select the word or phrase that best completes the sentence. This is a time limited test (i.e. 10 minutes of actual working time and 4 minutes of preparation /instruction time).

Figure Classification Test (FigClassification). The figure classification test of the nonverbal battery of the CCAT consists of 25 items. The test requires individuals to abstract the common element from three or four geometric figures and then to select the figure that goes with them. This is a time limited test (i.e. 10 minutes of actual working time and 4 minutes of preparation/instruction time).

Figure Analogies Test (FigAnalogies). The figure analogies test of the nonverbal battery of the CCAT consists of 25 items. The test requires individuals to discover the relationship between a pair of figures and then, given a third figure which is the first figure of a second pair, to select the figure that completes the analogy. This is a time limited test (i.e. 10 minutes of actual working time and 4 minutes of preparation /instruction time).

Figure Analysis Test (FigAnalysis). The figure analysis test of the nonverbal battery of the CCAT consists of 14 items. The test requires individuals to reconstruct a design from a sequence of cues. This is a time limited test (i.e. 10 minutes of actual working time and 4 minutes of preparation/instruction time).

All three tests from the nonverbal battery (figure classification, figure analogies, and figure analysis test) were administered to measure the students' abstract reasoning ability. Thorndike and Hagen (1989) emphasize that tests in the nonverbal battery do not involve words or numbers and that geometric shapes and figures used in the items have little direct relationship to formal school instruction. Thus, since no verbal stimuli are used in the items on the nonverbal battery, performance is not influenced by reading ability or language facility. Further, the geometric and spatial concepts required to solve the items in the nonverbal battery are acquired largely from out-of-school experiences. A cognitive ability composite score was formed by creating total scores from the non-verbal batteries and determining the standard scores of all four batteries to arrive at a cognitive ability z average score of sentence completion, figure classification, figure analogies, and figure analysis test.

Procedure

Before the study began, the investigator requested and received official permission to conduct research from the school's principal, superintendent of secondary schools, and school board officials via letters and meetings. The selection of potential participants, interviews of informed consent, and data collection were a cumulative, overlapping, and on-going process over a period of two school semesters.

At the end of the first school semester (i.e. 5 months), a master list of potential participants was generated consisting of an identified group of male students with one or more suspensions and non-identified group of male students with no school suspensions. This process resulted in identifying 49 male students who had experienced one or more suspensions during the first 5 months of school based on information provided by school personnel and a review of suspension records conducted by the investigator. The identified group of potential participants with one or more suspensions during the first 5 months of school represented approximately 10% of the male student population. These 49 students

were then matched in age with non-identified male students to generate a list of potential participants who had experienced no suspensions during the first 5 months of school.

Following the selection process, the investigator conducted interviews of informed consent with participants (either individually or in small groups of 3-6). During this interview process, four of the 49 identified male students who had met the criteria for inclusion in this study (i.e. one or more suspension) chose not to participate. As well, eight non-identified male students matched for age and who met the criteria for inclusion in the study as having had no school suspensions chose not to participate. On those occasions, the investigator interviewed the next potential candidate from a master list. Students who elected not to participate in this investigation cited such reasons as disinterest and concerns about missing school work and too many classes. As a result, following interviews of informed consent, 90 male students volunteered to participate in this investigation (i.e. 45 male students with one or more suspensions and 45 male students with no school suspensions).

Interviews of informed consent outlined permission to conduct the research, the purpose of the research, the importance of participation, and a commitment on the part of students to volunteer three 75 minute class periods to complete a teen perception questionnaire, 2 games, and a general ability task. Participation was voluntary. Students were assured of complete confidentiality and were assigned a research number. Each interview lasted approximately 20-30 minutes.

Letters of informed consent were collected prior to data collection. For adolescents under the age of consent (i.e. 18 years), parent permission was collected through letters of informed consent. For adolescents 18 years of age and over, the students signed consent forms and their parents received letters outlining the nature of the study and their son's agreement to participate in the study. All participants returned the letters of informed consent.

The data for this study were collected by the investigator during the second school semester (i.e. over a period of the next five months). Data collection took place in a vacant seminar room in the students' school during the normal school day. Appointment slips to release students from class were submitted by the investigator to the students' teachers the day prior to each data collection phase. Data collection occurred in three phases on three separate days for each student. All ninety students who volunteered to participate in the study completed all three phases of the research.

The first phase of data collection involved the completion of a series of questionnaires in the form of a researcher designed booklet. The booklet contained a section concerning general demographic information and three questionnaires: a risk perception questionnaire, a future life events inventory, and a thinking dispositions questionnaire. Following a review of instructions, the investigator remained available to answer any questions. This phase of data collection was conducted in small groups of 3-6 students and took approximately 60-70 minutes to complete.

Phase two of data collection involved two rational thinking behaviour tasks presented in the form of games. Those students who had completed all three questionnaires were next scheduled to play the two games. Data collection for phase two required one-to-one engagement with each participant. Thus, students were individually scheduled to complete this phase. The gambling game of cost-benefit reasoning was played first and took approximately 30-40 minutes to complete. The marble game of base rate information immediately followed and took approximately 20-30 minutes to complete. Upon completion of the games, the investigator transferred the sequence of card selections from the first behaviour task (gambling task of cost-benefit reasoning) onto score cards for each student and made observational notes on the session.

The third phase of data collection involved a general cognitive ability task. General ability was measured using the Canadian Cognitive Abilities Test (CCAT), Multilevel Edition, Level F, Form 7 (Thorndike & Hagen, 1989). Four subtests were selected: the

sentence completion test of the verbal battery and the figure classification, figure analogies, and figure analysis tests of the nonverbal battery. The CCAT was group administered by the investigator (i.e. in small groups of 6 to 10 students). All tests from the CCAT were time limited (i.e. 10 minutes of actual working time and 4 minutes of preparation/instruction time per test). Completion of all four subtests of the general cognitive ability task took approximately 56-60 minutes.

Chapter III

Results

The results chapter contains three sections. The first section examines data to explore whether the HSS group of students with multiple suspensions differ from the LSS group of students with low level suspensions on two self-reported measures and on two rational thinking tasks. In section two, intercorrelations among tasks and activities within the two groups of adolescents are explored to ascertain whether data support a syndrome of problem behaviour. The final section analyzes data to explore whether individual differences in adolescent risk involvement and risk behaviour perception are a function of cognitive ability, thinking dispositions, or mechanisms of rational thinking. Comparisons across groups (the LSS and HSS groups) were made using t-tests and analysis of variance (ANOVA). Correlations of variables within and between tasks were examined using a variety of correlation matrices.

Group Comparisons on Self-report Measures

Risk Perception Questionnaire

Table 1 presents the overall means and standard deviations on the participants' self-reported risk involvement, perception of peer involvement, and nine risk perception subscales across both primary and secondary risk activities. A series of t-tests were performed to compare the LSS and HSS groups. It is recognized that too many comparisons inflate the likelihood of statistical chance and the descriptions and elaborations here are intended to discern the overall trends and patterns reflected in this data.

Data show that the HSS group of students reported higher levels of involvement in primary risk activities, $t(88) = -3.72, p < .01$ and perceived less fear of the dangers associated with engaging in primary risk activities, $t(88) = 2.69, p < .05$. While the HSS group also reported engaging more often in socially desirable activities with elements of risk, results did not reach statistical significance. In a separate analysis (see Appendix E), the two groups were compared on their self-reported involvement across specific primary

and secondary risk activities. The HSS group reported greater involvement in four high risk activities including getting drunk [$t(88) = -2.05, p < .05$], smoking cigarettes [$t(88) = -4.79, p < .01$], using marijuana [$t(88) = -3.51, p < .01$], and taking drugs such as cocaine [$t(88) = -3.59, p < .01$]. These findings point toward a syndrome of problem behaviours associated with the HSS group of students.

Interestingly, the two groups of students did not differ greatly on several risk perception subscales across both primary and secondary activities where the mean differences were quite small. However, some trends suggest that the HSS group of students perceived more influence by their peers, greater benefits than risks, and less risk to both themselves and others for engaging in primary risk activities. There were also trends which suggested that the HSS group perceived less peer involvement, less fear of potential dangers, and few negative consequences for choosing not to engage in socially desirable activities with elements of risk.

Table 1

Mean Scores of the Low Suspension Students (N = 63) and High Suspension Students (N = 27) on Measures of Risk Involvement, Peer Involvement, and Risk Perception Subscales for Both Primary and Secondary Risk Activities (Standard Deviations in Parentheses)

Variable	LSS	HSS	t value
<u>Primary Risk Activities</u>			
Risk Involvement	1.51 (.44)	1.91 (.53)	-3.72 **
Perception of Peer Involvement	2.76 (.76)	2.91 (.63)	-0.93
Knowledge of risks	6.32 (.90)	6.11 (.94)	0.98
Avoidance of activity	5.57 (1.30)	5.46 (1.28)	0.36
Control of risks	4.44 (1.64)	4.46 (1.47)	-0.04
Influence of peers	2.06 (1.04)	2.39 (1.08)	-1.34
Fear of risks	4.96 (1.23)	4.15 (1.45)	2.69 *
Risk to self (personal risk)	5.12 (1.29)	4.77 (1.40)	1.14
Risk to others	5.22 (1.22)	4.73 (1.13)	1.77
Benefits greater than risks	2.39 (1.08)	2.81 (.92)	1.74
Not doing-negative consequences	2.49 (1.73)	2.56 (1.33)	-0.18
<u>Secondary Risk Activities</u>			
Risk Involvement	2.22 (.62)	2.35 (.68)	-0.86
Perception of Peer Involvement	2.75 (.62)	2.46 (.76)	1.94
Knowledge of risks	5.66 (1.18)	5.64 (1.23)	0.07
Avoidance of activity	4.84 (1.63)	5.18 (1.37)	-0.94
Control of risks	4.62 (1.20)	4.85 (.91)	-0.87
Influence of peers	3.06 (1.39)	3.04 (1.35)	0.07
Fear of risks	2.75 (1.04)	2.32 (1.18)	1.75
Risk to self (personal risk)	3.21 (1.09)	3.22 (1.59)	-0.03
Risk to others	3.19 (1.17)	3.14 (1.24)	0.17
Benefits greater than risks	4.57 (1.21)	4.79 (1.42)	-0.75
Not doing-negative consequences	2.67 (1.61)	2.15 (1.17)	1.50

Note: LSS = low suspension group, HSS = high suspension group

* = $p < .05$, ** = $p < .01$ degrees of freedom ranged between 82 to 88

Future Life Events Inventory

The Future Life Events inventory is the other self-reported measure in this investigation. This inventory explores a perception of optimism by examining how participants calibrate the future probability of experiencing positive and negative future life events in relation to themselves and other students their own age. Table 2 presents the overall means and standard deviations.

Analysis of data resulted in one significant finding. The LSS and HSS groups of students differed significantly in their assessments of experiencing positive future life events for themselves. Data show that the LSS group of students tended to view their own future probability of experiencing positive life events more optimistically than the HSS group of students, $t(88) = 2.11$, $p < .05$. In a separate analysis, the two groups of students also differed significantly on a level of optimism which examined their perceptions of experiencing positive future life events for themselves versus others, $t(87) = 2.25$, $p < .05$. That is, the LSS group of students viewed their future with optimism when calibrating their own likelihood of experiencing positive future life events in relation to others (LSS mean = 9.21, SD = 17.44). The HSS group, however, emerged as viewing their future with less optimism when calibrating their own likelihood of experiencing positive future life events in relation to others (HSS mean = 0.14, SD = 16.87). No significant group differences resulted for negative future life events.

Table 2

Mean Scores of the Low Suspension Students (N = 63) and High Suspension Students (N = 27) on the Future Life Events Inventory (Standard Deviations in Parentheses)

Variable	LSS	HSS	t value
<u>Positive Life Events</u>			
Self	67.04 (13.23)	60.5 (14.00)	2.11 *
Other	58.16 (14.76)	60.58 (11.10)	-0.75
<u>Negative Life Events</u>			
Self	26.52 (12.77)	26.01 (16.77)	0.16
Other	41.47 (16.58)	40.04 (14.88)	0.38

Note: LSS = low suspension group, HSS = high suspension group

* = $p < .05$ degrees of freedom ranged between 86 to 88

Group Comparisons on Reasoning Tasks

The Gambling Task of Cost-Benefit Reasoning

This task explored the participants' sensitivity to future consequences by examining their use of cost-benefit reasoning while playing a game of cards. The task was adapted from Bechara et al. (1994) and is termed the gambling task. Selections from all four decks resulted in varying rewards, but each deck also delivered penalties of different magnitudes on pre-determined fixed schedules. The participants' mean number of selections were analyzed.

The performances of the LSS and HSS groups of students were compared on the gambling task of cost-benefit reasoning as a mechanism of rational thinking behaviour. The overall means and standard deviations are presented in Table 3. It is acknowledged that too many comparisons using t-tests inflate the likelihood of statistical chance. In addition to reporting group comparisons which are statistically significant, descriptions are also intended to discern overall patterns and trends reflected in the data.

Generally, no significant differences resulted when groups were compared on their mean number of card selections over the entire 100 draws from each of the four decks of cards (A, B, C, and D). Despite this finding, there was a tendency for the LSS group to choose fewer cards from the disadvantageous decks (A and B) and more cards from the advantageous decks (C and D). For example, the LSS group chose three more cards on average from the advantageous deck D a difference that approached significance even on a two-tailed test, $t(88) = 1.69$, $.05 < p < .10$.

The next two comparisons in Table 3 examine the groups' mean number of 100 draws from the two combined disadvantageous decks (A+B) and the two combined advantageous decks (C+D). In the long run, decks A and B were considered disadvantageous because selecting from these decks would result in an overall net loss while decks C and D were advantageous in the long run because selections from these

decks would result in an overall net gain. Since the means of the combined decks are complements, the t value and effect size for both comparisons is the same. Nevertheless, a closer examination of means indicates that across all of the 100 trials, the LSS group chose over four more cards from the combined advantageous decks (C+D), a difference that approached significance even on a two-tailed test, $t(88) = 1.88$, $.05 < p < .10$ and was significant on a one-tailed test. The difference translated into an effect size of .437 which Rosenthal and Rosnow (1991, p. 446) classify as "moderate."

The next four lines in Table 3 outline the groups' mean number of cards over the last 50 draws from each of the four decks. The last 50 draws are considered to reflect the participants' determined choices following a period of experimentation in learning the penalties associated with selecting various cards from each of the four decks. In this analysis, not only is there a tendency for the LSS group to choose fewer cards from the disadvantageous decks (A and B) and more cards from the advantageous decks (C and D), but over the last 50 draws the difference for both decks B and D was statistically significant.

The last two comparisons probed the groups' mean number of cards over the last 50 draws of the combined disadvantageous decks (A+B) and the combined advantageous decks (C+D). In the analysis, the LSS group (mean = 28.063) tended to draw more often from the combined advantageous decks (C + D) than the HSS group (mean = 23.963). In other words, the LSS group chose over four more cards from the combined advantageous decks and four fewer cards from the combined disadvantageous decks, a difference that was statistically significant even on a two-tailed test, $t(88) = 2.50$, $p = < .025$. The difference translated into an effect size of .582 which Rosenthal and Rosnow (1991, p. 446) classify as slightly greater than "moderate." Given that the mean difference in the number of cards drawn from the advantageous decks C and D (slightly over four cards) was the same over the last 50 cards as it was for the full set of 100 draws indicates that the

performance difference arises almost entirely from the last 50 cards i.e. after the different properties of the decks have been registered.

The different patterns of card selections on the gambling task had implications for the monetary outcomes experienced by the two groups of students. For example, the HSS group lost \$3.51 more than the LSS group after the 100 card selections, a difference that was statistically significant, $t(88) = 2.11, p < .05$. Both groups experienced mean losses largely because after the first block of ten cards, the large \$12.50 and \$2.50 penalties in decks B and D occur early in each block of ten. Nevertheless, winning was possible. In fact, twenty-five of the participants had net gains and three (all in the LSS group) earned \$10.00 above their stake.

Overall trends on the gambling task which tapped the participants' sensitivity to future consequences, tends to support findings on the self-reported measures. The HSS group of students who displayed low risk behaviour perception and low optimism are the same group of students who tended to select cards most often from the disadvantageous decks on the gambling task. These findings suggest that high risk involvement and low risk perception may be associated with low sensitivity to future consequences in cost-benefit reasoning. By contrast, the LSS group who reported low risk involvement and high risk behaviour perception tended to show a greater sensitivity toward future consequences on the gambling task by electing to draw more often from the advantageous decks.

Table 3

Mean Scores of the Low Suspension Students (N = 63) and High Suspension Students (N = 27) on the Gambling Task of Cost-Benefit Reasoning (Standard Deviations in Parentheses)

Variable	LSS	HSS	t (88)
<u>Gambling Task</u>			
Deck A (100 selections)	20.0 (6.0)	21.1 (8.3)	-0.74
Deck B (100 selections)	25.9 (8.1)	29.1 (10.8)	-1.55
Deck C (100 selections)	24.8 (7.2)	23.7 (6.4)	0.70
Deck D (100 selections)	29.3 (8.6)	26.1 (7.9)	1.69
Deck A+B (100 selections)	45.9 (10.1)	50.3 (10.1)	-1.88 †
Deck C+D (100 selections)	54.1 (10.1)	49.7 (10.1)	1.88 †
Deck A (last 50 selections)	8.9 (4.4)	9.9 (6.3)	-0.85
Deck B (last 50 selections)	13.0 (6.0)	16.1 (8.1)	-2.03 *
Deck C (last 50 selections)	13.2 (5.6)	11.9 (4.9)	1.04
Deck D (last 50 selections)	14.9 (6.2)	12.1 (5.1)	2.06 *
Deck A+B (50 selections)	21.9 (7.2)	26.0 (7.0)	-2.50 **
Deck C+D (50 selections)	28.1 (7.2)	24.0 (7.0)	2.50 **
Monetary Outcome	-\$2.65 (7.40)	-\$6.16 (6.82)	2.11 *

Note: LSS = low school suspension group

HSS - high school suspension group

* = $p < .05$, ** = $p < .025$, all two-tailed

† = $p < .10$

Deck A, Deck B = disadvantageous decks in the long run

Deck C, Deck D = advantageous decks in the long run

The Marble Task of Base Rate Reasoning

The second reasoning task tapped the participants' rational and experiential or intuitive processing systems through a game of chance adapted from Denes-Raj and Epstein (1994). This task probed whether participants made nonoptimal, irrational decisions using base rate information by electing to draw from a bowl that they recognized would offer less favourable objective probabilities than an alternative bowl (Denes-Raj & Epstein, 1994). The participants' mean rational draws on these trials and their total rational choices are examined.

Table 4 compares the performance of the LSS and HSS groups of students on the marble task of base rate reasoning. Analysis of data show no significant group differences. In fact, the difference of group means over the five win trials and two additional win trials were quite small. However, some trends are notable, namely, the LSS group made more rational choices on the 5 lose trials and on their total rational choices.

Interestingly, both groups performed poorly on this apparently simple, practical decision making task. Data indicate that a majority of both groups of adolescents preferred a 9% chance of winning \$1 to a 10% chance of winning \$1. These results parallel findings by Denes-raj and Epstein (1974) who administered this task to college students.

Table 4

Mean Rational Draws Made by the Low Suspension Students (N = 63) and High Suspension Students (N = 27) on the Marble Task of Base Rate Reasoning (Standard Deviations in Parentheses)

Variable	LSS	HSS	t (88)
<u>Marble Task</u>			
5 Win Trials	2.11 (1.08)	2.07 (1.14)	0.15
5 Lose Trials	3.43 (1.51)	3.19 (1.64)	0.68
2 Additional Win Trials	0.84 (0.81)	0.96 (0.81)	-0.66
Total Rational Choices	6.38 (2.30)	6.22 (2.03)	0.31

Note: LSS = low suspension group HSS = high suspension group

Relationships Among Tasks and Activities on Self-report Measures

In the second section of the results chapter, data are analyzed to explore whether intercorrelations exist among tasks and activities within the two groups of adolescents to support a syndrome of problem behaviour. The body of literature on risk taking behaviour by adolescents has primarily encompassed self-reported measures. In this investigation, both self-reported measures and behavioural reasoning tasks were used. Thus far, the HSS group of students with multiple suspensions have responded consistently on these sets of measures. Are students who displayed high risk choices on the gambling task the same individuals who exhibited low risk perception on the risk perception questionnaire? Relationships between these measures would provide further evidence for a syndrome of problem behaviour. To explore this hypothesis, several correlation matrices were constructed to examine potential associations among a variety of tasks and activities.

Intercorrelations Between Variables on the Risk Perception Questionnaire

The intercorrelations between six variables from the risk perception questionnaire are presented in Table 5. An analysis of potential associations between variables from the risk perception questionnaire resulted in several significant findings. Data show that involvement in primary activities was positively correlated with involvement in secondary activities ($r = .394, p < .001$). The more participants reported engaging in primary risk activities, the more they tended to report engaging in socially desirable activities with risk elements. In fact, both the LSS and HSS groups of students reported engaging in all risky activities. However, it was the HSS group of students with multiple suspensions who reported engaging in primary activities more often than their LSS group counterparts (a difference that was statistically significant).

The participants' involvement in primary risk activities was negatively correlated with their perceptions of risk for engaging in these high risk activities ($r = -.245, p < .01$). The more participants reported engaging in primary activities, the less they tended to perceive the inherent risks associated with these activities. Likewise, involvement in

socially desirable activities with elements of risk (i.e. secondary activities) was negatively correlated with the participants' perceptions of risk for engaging in these activities ($r = -.203$), however the correlation did not reach statistical significance. Furthermore, perceptions of risk for primary and secondary activities were positively correlated ($r = .309$, $p < .01$). Participants who acknowledged and perceived the risks associated with engaging in primary activities were also more likely to perceive the potential dangers associated with secondary risk activities. These findings suggest that risk perceptions may serve as "regulating" factors with the goal of reducing risk for participants.

Perceptions of peer involvement in primary activities was positively correlated with perceptions of peer involvement in secondary activities ($r = .415$, $p < .001$). Participants who perceived their peers as engaging in high risk activities also tended to perceive their peers as engaging in secondary activities with risk elements. Perceptions of peer involvement in primary activities was also positively correlated with the participants self-reported involvement in primary activities ($r = .312$, $p < .001$). Likewise, perceptions of peer involvement in secondary activities was positively correlated with the participants' actual involvement in secondary activities ($r = .293$, $p < .01$). Thus, participants who perceived their peers as engaging in either primary or secondary activities were also more likely to report engaging in these activities.

Table 5

Intercorrelations Between Variables on the Risk Perception Questionnaire

(N = 90)

Variables	1	2	3	4	5	6
1. Primary Risk Perceptions (Composite)	—					
2. Risk Involvement (Primary Activities)	-0.245*	—				
3. Peer Involvement (Primary Activities)	0.048	0.312**	—			
4. Secondary Risk Perceptions (Composite)	0.309**	-0.107	-0.052	—		
5. Risk Involvement (Secondary Activities)	0.005	0.394***	0.137	-0.203	—	
6. Peer Involvement (Secondary Activities)	0.200	0.075	0.415***	-0.149	0.293 **	—

* = Correlations larger than .207 are significant at the .05 level (two-tailed)

** = Correlations larger than .270 are significant at the .01 level (two-tailed)

*** = Correlations larger than .341 are significant at the .001 level (two-tailed)

Note:

Primary Risk Perceptions (Composite) = sum of risk perceptions for primary activities in set one minus the sum of risk perceptions for primary activities in set two

Secondary Risk Perceptions (Composite) = sum of risk perceptions for secondary activities in set one minus the sum risk perceptions for secondary activities in set two

Intercorrelations Between Variables on the Future Life Events Inventory

Intercorrelations between four variables from the Future Life Events Inventory are presented in Table 6. Two significant correlations resulted from this analysis. These correlations were found to be in the expected direction. The more participants predicted that they would experience positive future life events, the less they tended to expect negative future life events ($r = -.318, p < .01$). As well, the more participants predicted they would experience negative future life events, the more they tended to predict that others would also experience negative future life events ($r = .481, p < .001$).

Table 6

Intercorrelations Between Variables on the Future Life Events Inventory

(N = 88)

Variables	1	2	3	4
1. Positive Future Life Events for Self	—			
2. Negative Future Life Events for Self	-0.318 **	—		
3. Positive Future Life Events for Others	0.172	-0.061	—	
4. Negative Future Life Events for Others	0.015	0.481 ***	-0.190	—

Note: 2 cases deleted with missing values

* = Correlations larger than .207 are significant at the .05 level (two-tailed)

** = Correlations larger than .270 are significant at the .01 level (two-tailed)

*** = Correlations larger than .341 are significant at the .001 level (two-tailed)

Correlations Among Variables on the Risk Perception Questionnaire and the Future LifeEvents Inventory

Correlations between variables from the two self-reported measures in this study are presented in Table 7. Variables from the risk perception questionnaire include the overall composites of risk perception, risk involvement, and peer involvement. Variables from the future life events inventory consist of the participants' calibrated means of experiencing positive and negative future life events for both themselves and others.

Generally, participants who reported engaging in risk activities tended to predict that they would experience negative future life events ($r = .253, p < .05$). This correlation is consistent with data on group comparisons which demonstrated that participants high in risk involvement (i.e. HSS group) displayed low optimism when predicting their own positive future life events. Risk perception was positively correlated with the participants' expectation that they would experience good things in the future ($r = .21, p < .05$) while others would experience bad things in the future ($r = .22, p < .05$). That is, those high in risk perception (i.e. LSS group) tended to predict they would experience positive life events while others would experience negative life events in the future.

Thus, correlations between variables on the two self-reported measures in this analysis are consistent with group comparisons on these measures. High risk involvement (i.e. HSS group) was correlated with predictions of experiencing negative versus positive life events for oneself. High risk perception (i.e. LSS group) was correlated with predictions of experiencing positive future life events while others would experience negative events in the future. These findings tend to support a syndrome of problem behaviours.

Table 7

Correlations Among Variables on the Risk Perception Questionnaire and the Future Life Events Inventory

(N = 88)

Variables	1	2	3	4	5	6	7
1. Risk Perceptions (Overall Composite)	—						
2. Risk Involvement (Overall Composite)	-0.195	—					
3. Peer Involvement (Overall Composite)	0.006	0.297**	—				
4. Positive Life Events (Self)	0.210*	-0.129	0.114	—			
5. Negative Life Events (Self)	-0.098	0.253*	0.114	-0.318**	—		
6. Positive Life Events (Others)	-0.165	0.026	0.147	0.172	-0.061	—	
7. Negative Life Events (Others)	0.220*	0.091	0.115	0.015	0.481***	-0.19	—

Note: 2 cases deleted with missing values

* = Correlations larger than .207 are significant at the .05 level (two-tailed)

** = Correlations larger than .270 are significant at the .01 level (two-tailed)

*** = Correlations larger than .341 are significant at the .001 level (two-tailed)

Risk Perceptions (Overall Composite) = sum of composites for primary risk perceptions and secondary risk perceptions

Risk Involvement (Overall Composite) = sum of risk involvement for primary activities and risk involvement in secondary activities

Peer Involvement (Overall Composite) = sum of perceptions of peer involvement in primary activities and perceptions of peer involvement in secondary activities

Correlations Between the Two Reasoning Tasks

Overall, no meaningful or significant relationships were found between the two rational thinking behaviour tasks. In a separate analysis, there was a lack of correlation between the win and lose trials on the marble task of base rate reasoning. There was also a lack of correlation between the two mechanisms of rational thinking i.e. sensitivity to consequences through cost-benefit reasoning (gambling task) and using base rate information through statistical reasoning (marble task).

Correlations Among the Risk Perception Questionnaire, the Future Life Events Inventory, and Rational Thinking Tasks

Table 8 explores potential associations among eight selected variables from the self-reported measures and the two rational thinking tasks to further investigate a syndrome of problem behaviour. The overall composites of risk perception, risk involvement, and perceptions of peer involvement are correlated with five other variables. Two variables are selected for analysis from the future life events inventory: positive and negative future life events relating to the self. Three variables are selected from the rational thinking tasks. From the gambling task of cost-benefit reasoning, the variables are: the participants' mean number of selections from the combined advantageous decks (C + D) over the last 50 draws and their total earnings above the stake. From the marble task of statistical reasoning (i.e. using base rate information), the participants' total number of rational choices are selected for analysis.

Generally, data show no significant correlations between self-reported measures (i.e. risk perception questionnaire variables, future life events variables) and the two rational thinking behaviour tasks (i.e. gambling task variables, marble task variable). In fact, analysis of data resulted in weak trends between the variables. Although in a separate analysis, there was a lack of correlations between the win and lose trials on the marble task of using base rate information in reasoning, data in Table 8 show some trends which are identified for discussion. For example, although not statistically significant, risk

involvement was negatively correlated with the combined advantageous decks (C + D) on the gambling task ($r = -.134$). The more participants engaged in risk activities (e.g. HSS group), the less they tended to draw from the combined advantageous decks (C + D). In fact, group comparisons on the gambling task showed that it was the HSS group who tended to draw more frequently from the disadvantageous decks. Thus, participants high in risk involvement also tended to be the high risk choosers on the gambling task of cost-benefit reasoning.

Thus, data show few or no relationships between self-reported measures of risk involvement/risk behaviour perception and predicting future life events with the participants' performance on real life decision making which tapped mechanisms of rational thinking behaviour. Nevertheless, there was some qualified support for a syndrome of problem behaviour. Findings suggest a profile of students in the HSS group who performed poorly on the gambling task of cost-benefit reasoning which probed their sensitivity to consequences and who are not attuned to the risks or dangers associated with engaging in risk activities. Finally, correlations were performed between the specific primary and secondary activities as a final examination of whether reported risk related behaviors tend to co-occur.

Table 8

Correlations Among the Risk Perception Questionnaire, the Future Life Events Inventory,
and Rational Thinking Tasks

(N = 90)

Variable	1	2	3	4	5	6	7	8
1. Risk Perceptions (Overall Composite)	—							
2. Risk Involvement (Overall Composite)	-0.193	—						
3. Peer Involvement (Overall Composite)	0.028	0.292**	—					
4. Positive Life Events (Self)	0.181	-0.124	0.089	—				
5. Negative Life Events (Self)	-0.069	0.251*	0.132	-0.326**	—			
6. Gambling Task: C+D (last 50 draws)	0.085	-0.134	0.069	0.143	0.069	—		
7. Gambling Task: (Total Earnings)	0.098	-0.083	0.091	0.066	0.095	0.775***	—	
8. Marble Task: (Total Rational Choices)	-0.099	0.033	0.066	-0.082	0.143	0.017	0.100	—

* = Correlations larger than .207 are significant at the .05 level (two-tailed)

** = Correlations larger than .270 are significant at the .01 level (two-tailed)

*** = Correlations larger than .341 are significant at the .001 level (two-tailed)

Note:

Risk Perceptions (Overall Composite) = sum of composites for primary and secondary risk perceptions

Risk Involvement (Overall Composite) = sum of risk involvement in primary activities and risk involvement in secondary activities

Peer Involvement (Overall Composite) = sum of perceptions of peer involvement in primary activities and perceptions of peer involvement in secondary activities

Gambling Task: C + D (last 50 draws) = mean number of card selections from combined advantageous decks C + D over the last 50 draws

Gambling Task (Total Earnings) = total earnings above stake on the gambling task of cost-benefit reasoning

Marble Task (Total Rational Choices) = total rational responses on the marble task of base rate reasoning

Intercorrelations Among Eleven Specific Primary and Six Specific Secondary Risk

Activities

A syndrome of problem behaviour has traditionally been conceptualized in the literature by examining the intercorrelations between risk activities. Table 9 presents a summary of intercorrelations between eleven specific primary and six specific secondary risk activities. Only focal points are reported. A positive correlation between a pair of activities would indicate that people who engage in one activity also tend to engage in the other. The finding that 51 out of 66 correlations were positive points toward a syndrome of problem behaviour. Twenty of these positive correlations were significant. Data which show that all risk activities (both primary and secondary activities) tend to be interrelated rather than a collection of independent activities supports previous work by Jessor (1984) and Bentin et al. (1993). Analysis also resulted in 15 inverse relationships among primary and secondary risk activities, but these associations were quite small and not found to be significant.

Although identified as secondary risk activities in this investigation, cutting class/skipping school and playing sports emerged as having positive and significant correlations with several primary risk activities. All of the high risk activities that the HSS group reported on were positively correlated with cutting class/skipping school. Specifically, cutting classes or skipping school was positively and significantly correlated with smoking cigarettes ($r = .502, p < .001$), using marijuana ($r = .455, p < .001$), drinking alcoholic beverages ($r = .410, p < .001$), and getting drunk ($r = .449, p < .001$). In addition, cutting school and engaging in physical fights were positively correlated, but just attained significance ($r = .207, p < .05$).

Playing sports which is a socially acceptable and desirable activity in our culture was positively and significantly correlated with several primary risk activities. Specifically, participants who were found to play sports also tended to engage in physical fights ($r = .353, p < .001$), steal or shoplift ($r = .346, p < .001$), have unprotected sex

($r = .273, p < .01$), ride with a drunk driver ($r = .265, p < .05$), and engage in vandalism ($r = .225, p < .05$). Playing sports and getting drunk were also positively correlated, but just reached significance ($r = .207, p < .05$). In the discrete analysis reported previously, it was the HSS group of students who reported engaging in these same primary activities more often than students in the LSS group. Several of those findings had approached significance even on a two-tailed test.

These findings supported a syndrome of problem behaviour whereby both high risk activities and socially desirable activities with risk elements tended to be intercorrelated. Further, these correlations add to the descriptive profile of students in the HSS group who performed poorly on the cost-benefit reasoning task and were not attuned to the inherent risks associated with engaging in risky activities.

Table 9

Intercorrelations Among Both Eleven Specific Primary Risk Activities and Six Specific Secondary Risk Activities

(N = 90)

Variable	Ride Bike	Swimming	Play Sports	Skateboard/ Rollerblade	Cut Class/ Skip School	Ride MotorCycle
1. Drinking	-0.017	0.054	0.025	0.205	0.410 ***	0.101
2. Getting drunk	-0.012	0.163	0.207 *	0.224 *	0.449 ***	0.248 *
3. Smoking	-0.135	-0.157	-0.027	0.079	0.502 ***	0.185
4. Marijuana	0.038	0.091	0.183	0.051	0.455 ***	0.178
5. Taking drugs	-0.057	-0.071	0.034	0.014	0.105	-0.011
6. Ride drunk driver	0.147	0.203	0.265 *	0.104	0.086	0.419 ***
7. No seatbelt	-0.034	-0.026	0.074	0.115	0.009	0.126
8. Unprotected sex	-0.109	-0.066	0.273 **	0.016	0.135	-0.061
9. Stealing	0.091	0.207 *	0.346 ***	0.137	-0.048	-0.055
10. Fighting	0.156	0.260 *	0.353 ***	0.054	0.207 *	0.335 **
11. Vandalism	0.237 *	0.292 **	0.225 *	0.190	0.104	0.330 **

* = Correlations larger than .207 are significant at the .05 level (two-tailed)

** = Correlations larger than .270 are significant at the .01 level (two-tailed)

*** = Correlations larger than .341 are significant at the .001 level (two-tailed)

Individual Differences on Measures of Cognitive Ability, Thinking Dispositions,

Risk Perception, and Reasoning about Risk

The analyses reported in this section were conducted in order to explore whether individual differences in adolescent risk involvement and risk behaviour perception are a function of cognitive ability, thinking dispositions, or mechanisms of rational thinking behaviour. Table 10 compares the two groups of students on four subtests from the Canadian Cognitive Abilities Test (CCAT), their general cognitive ability (i.e. overall composite z score), and on nine thinking dispositions determined to have the potential for influencing risk taking and risk behaviour perception. While it is recognized that the number of comparisons using t-tests may inflate the likelihood of statistical chance, the descriptions and elaborations in this analysis are intended to discern the overall trends and patterns reflected in the data.

Individual Differences in Cognitive Ability and Thinking Dispositions

As shown in Table 10, the LSS and HSS groups of students did not differ on measures of cognitive ability. Group comparisons on the nine personality/thinking dispositions, although not statistically significant, did suggest certain overall trends which add to the descriptive profiles of the two groups of students. For example, the LSS group of students with low risk involvement and high risk behaviour perceptions displayed a greater propensity toward dispositions of actively open-mind thinking, deliberation of outcomes, and consideration of future consequences. On the other hand, the HSS group of students with high risk involvement and low risk behaviour perceptions displayed a greater propensity toward paranormal beliefs and external control factors as a thinking disposition. These findings suggest a need to explore whether risk involvement and risk behaviour perceptions are a function of cognitive ability, thinking dispositions, or mechanisms of rational thinking behaviour.

Table 10

Mean Scores of the Low Suspension Students (N = 63) and High Suspension Students (N = 27) on Measures of Cognitive Ability and Thinking Dispositions (Standard Deviations in Parentheses)

Variable	LSS	HSS	t (88)
<u>Cognitive Ability</u>			
Sentence Completion (max = 25)	17.02 (4.07)	16.41 (3.80)	0.66
Figure Classification (max = 25)	13.83 (3.86)	12.74 (3.62)	1.24
Figure Analogies (max = 25)	15.30 (4.13)	14.78 (5.11)	0.51
Figure Analysis (max = 15)	8.19 (3.82)	8.48 (3.59)	-0.34
Cognitive Ability Composite	0.04 (0.80)	-0.08 (0.82)	0.65
<u>Thinking Dispositions</u>			
1. Actively Open-Minded Thinking	41.98 (6.33)	39.22 (6.74)	1.86
2. Counter Factual Thinking	7.86 (3.10)	7.44 (3.19)	0.57
3. Paranormal Beliefs	14.25 (5.90)	16.78 (6.87)	-1.77
4. Impulsiveness (NEO-N5)	28.81 (4.37)	28.37 (6.35)	0.38
5. Deliberation (NEO-C6)	30.05 (6.17)	28.41 (4.58)	1.24
6. Ideas (NEO-05)	31.35 (6.42)	31.96 (4.80)	-0.45
7. Social Desirability Response	20.21 (3.84)	20.82 (3.64)	-0.70
8. Consideration of Future Consequences	43.40 (8.21)	41.56 (6.57)	1.03
9. New Personal Fable Scale	45.37 (7.54)	46.33 (7.58)	-0.56

Note: LSS = low suspension group, HSS = high suspension group

Cognitive ability subtest scores = raw scores with no correction for age

Cognitive ability composite = composite z score

A correlation matrix was then constructed to explore relationships among variables from the two self-reported measures and the two rational thinking behaviour tasks with cognitive ability (composite z score) and the four thinking dispositions which had displayed trends in the analysis of group comparisons: i.e. actively open-minded thinking, paranormal beliefs, deliberation, and consideration of future consequences. Variables from the self-reported measures include the three overall composites created from the participants' responses on the risk perception questionnaire and the participants' perceived probabilities that they would experience positive and negative future life events from the future life events inventory. Variables from the gambling task of cost-benefit reasoning include the participants' mean number of selections from the combined advantageous decks (C + D) over the last 50 draws and their total earnings above the stake (i.e. net gain). From the marble task of base rate reasoning, the participants' total number of rational choices are included for analysis.

Table 11 presents a summary of correlations. Results show that risk perceptions were positively associated with cognitive ability ($r = .255, p < .05$) and with two thinking dispositions: actively open-minded thinking ($r = .411, p < .001$) and consideration of future consequences ($r = .283, p < .01$). Participants who displayed a greater awareness of risk behaviour perception (i.e. LSS group) tended to have higher scores on cognitive ability measures (despite findings that the two groups of students had not differed on cognitive ability). They also displayed a greater propensity toward actively open-minded thinking and the consideration of future consequences. This was not true for risk perceptions and paranormal beliefs which were negatively correlated ($r = -.298, p < .01$). Participants high in risk perception awareness were less likely to exhibit a disposition toward paranormal beliefs.

Risk involvement was found to be positively correlated with paranormal beliefs ($r = .354, p < .001$), but negatively correlated with both actively open-minding thinking ($r = -.226, p < .05$) and deliberation ($r = -.306, p < .01$). This is consistent with previous discrete analyses in which the HSS group who reported engaging in risk activities more often than their LSS counterparts displayed a greater tendency toward paranormal beliefs or external control as a thinking disposition. These students were less likely to display a willingness to change ones' belief in the face of contradictory evidence (i.e. actively open-minding thinking) suggesting a confirmation bias. Participants high in risk involvement were less likely to deliberate the possible outcomes of engaging in certain behaviours.

Predicting positive future life events for oneself was positively correlated with dispositions of actively open-minding thinking and with the consideration of future consequences ($r = .257, p < .05$ and $r = .306, p < .01$ respectively). Results were consistent with findings that the LSS group of students were more likely to expect good things in the future. Data show that participants who expected to have negative future life events were less likely to consider future consequences ($r = .246, p < .05$). There was also a trend for participants who predicted negative future life events to exhibit a tendency toward paranormal beliefs ($r = .156$) but not toward actively open-minded thinking ($r = -.148$). Correlations however did not reach statistical significance. These findings are consistent with the profile of the HSS group of students.

On the gambling task of cost-benefit reasoning, participants who selected more often from the combined advantageous decks displayed a trend toward reflectiveness in actively open-minded thinking ($r = .179$) and were less likely to embrace paranormal beliefs ($r = -.156$). Although correlations did not reach statistical significance, these trends are consistent with a profile of the LSS group of students who displayed a greater sensitivity toward future consequences in their cost-benefit reasoning performance by electing to draw more often from the combined advantageous decks.

Table 11

Correlations Among Self-report Measures, Rational Thinking Tasks, Cognitive Ability, and Thinking Dispositions

(N = 90)

Variable	Cognitive Ability	Actively Open-minded	Paranormal Beliefs	Deliberation	Consider Future Consequences
Risk Perceptions (Overall Composite)	0.255 *	0.411 ***	-0.298 **	0.193	0.283 **
Risk Involvement (Overall Composite)	0.004	-0.226 *	0.354 ***	-0.306 **	-0.104
Peer Involvement (Overall Composite)	0.089	0.010	-0.023	-0.067	-0.071
Positive Life Events (Self)	0.185	0.257 *	-0.072	0.175	0.306 **
Negative Life Events (Self)	-0.037	-0.148	0.156	-0.073	-0.246 *
Gambling Task: C+D (last 50 draws)	0.085	0.179	-0.156	0.048	-0.079
Gambling Task: (Total Earnings)	0.046	0.073	-0.102	-0.121	-0.090
Marble Task: (Total Rational Choices)	0.143	0.004	-0.022	-0.273 **	-0.099

* = Correlations larger than .207 are significant at the .05 level (two-tailed)

** = Correlations larger than .270 are significant at the .01 level (two-tailed)

*** = Correlations larger than .341 are significant at the .001 level (two-tailed)

Note:

Risk Perceptions (Overall Composite) = sum of composites for primary risk perceptions and secondary risk perceptions

Risk Involvement (Overall Composite) = sum of risk involvement in primary activities and risk involvement in secondary activities

Peer Involvement (Overall Composite) = sum of perceptions of peer involvement in primary activities and perceptions of peer involvement in secondary activities

Gambling Task: decks C + D, last 50 draws = mean number of card selections from combined advantageous decks C + D over the last 50 draws

Gambling Task (Total Earnings) = total earnings above stake on the gambling task of cost-benefit reasoning

Marble Task (Total Rational Choices) = total rational responses on the marble task of base rate reasoning

Chapter IV

Discussion and Implications

In this investigation, the HSS group of students with multiple suspensions differed from the LSS group of students with low level suspensions along several dimensions. First, the HSS group of students reported higher levels of involvement in risk activities and displayed less sensitivity or awareness of risk behaviour perceptions which could serve as "regulating" factors with the goal of reducing risk. Interestingly, Benthin et al. (1993) have noted that it is behaviour which may drive perceptions rather than the reverse. Second, they were less optimistic about their future and believed they were unlikely to experience positive future life events. In contrast, the LSS group who reported less risk involvement and expressed a greater sensitivity of risk behaviour perceptions were more optimistic about their future in relation to positive life events. While the groups did not differ in their own probabilities of experiencing negative future life events, they both predicted that other students their age would have a greater chance of encountering negative life events in the future. Third, in two real life decision making tasks, the HSS group emerged as the high risk choosers on the gambling task which tapped their sensitivity to consequences through cost-benefit reasoning and tended to make fewer rational choices on the marble task which probed statistical reasoning through the use of base rate information.

Data show some support for a syndrome of problem behaviour as traditionally reported in the literature on adolescence, but few relationships were obtained between the two self-reported measures and the two reasoning tasks. For example, the intercorrelations between specific primary and secondary risk activities point toward a syndrome of problem behaviour and indeed it was the HSS group of students who reported engaging more often in those primary risk activities which were found to be intercorrelated. However, data show little or no relationships between self-reported measures of risk involvement, risk behaviour perceptions, and predictions of future life events with performance on the two rational thinking behaviour tasks.

The LSS and HSS groups of students did not differ on general cognitive ability, but some trends on the thinking dispositions differentiated the LSS and HSS groups of students. In further analyses with the tasks, some interesting relationships between cognitive ability, thinking dispositions, and performance on reasoning tasks typically emerged in the expected direction. On the thinking dispositions, a greater sensitivity or awareness of risk behaviour perceptions and perceived probabilities of experiencing positive future life events were found to be associated with cognitive ability, actively open-minded thinking, deliberation of outcomes, and the consideration of future consequences. These findings were consistent with the descriptive profile of the LSS group of students. Higher levels of risk involvement and perceived probabilities of experiencing negative future life events, however were associated with paranormal beliefs and external control factors. The former was consistent with the HSS group profile. As a mechanism of rational thinking behaviour, a greater sensitivity to consequences through cost-benefit reasoning was related to actively open-minded thinking. This disposition was displayed by the LSS group rather than the HSS group. The HSS group displayed a propensity toward high risk choices (both self-reported and on this real life decision making task) suggesting a decreased sensitivity to consequences. Overall trends and patterns of data which examined whether individual differences among the various tasks were associated with cognitive ability or thinking dispositions are explained using a somatic marker hypothesis (Bechara et al., 1994, 2000; Bechara, Damasio, & Damasio, 2000) and a generic dual process framework for reasoning performance (Stanovich, 1999; Stanovich & West, 1998, 2000).

Do Adolescents in the High Risk Group Differ from Adolescents in the Low Risk Group?

The analytic strategy used in the present investigation was to examine the mixed claims in the research about risk taking behaviour in adolescence. As a group, adolescents have been described as believing that they are invulnerable to risk and more likely to engage in high risk behaviours. Is this a folk belief or is the concern of risk involvement and poor risk perception a real cause for concern in adolescence? This question was examined by

comparing high and low risk adolescents on a set of self-report risk perception measures and reasoning tasks. The results indicated that high risk adolescents (i.e. HSS group) perceived less risk awareness in high risk activities whereas the low risk adolescents (i.e. LSS group) perceived a greater risk awareness of all risky activities. Differences between the two groups were also found on one of the reasoning tasks.

Risk Behaviour Perception

Overall trends from the two self-report measures generated two distinct profiles of the LSS and HSS groups of students. The LSS group of students showed consistency across risk perception, risk involvement, and their expectations for the future. For example, the LSS group of students were better calibrated in the domain of risk perception in that they demonstrated a sensitivity and a greater awareness of risk behaviour perceptions. They also reported less involvement in all risk activities, a greater knowledge of risks, and were less likely to be influenced by their peers to engage in high risk activities. As well, they expressed more fear of the activities' inherent risks and perceived a greater sense of risk to both themselves and others for engaging in primary activities. The LSS group also perceived their peers as engaging in secondary activities and believed there would be negative consequences for choosing not to engage in socially desirable activities with elements of risk. These findings suggest a strong sense of social desirability responses and implies association with a peer group of similar response patterns.

A different profile emerged for the HSS group of high risk taking students who may be vulnerable to risk. The HSS group of students were poorly calibrated in the domain of risk perception. For example, they tended to display less sensitivity and awareness of risk behaviour perceptions (e.g. less fear of risks and less risk to self or others), but reported more involvement in high risk activities such as using alcohol and tobacco which are risk activities identified by Irwin (1993) as "gateway drugs" for the use of illicit substances. Indeed, they had also reported using marijuana and taking drugs such as cocaine. Despite the contradictory views in the literature on the role of peers (Ungar,

2000), there was a trend for the HSS group in this study to perceive a greater element of peer influence to engage in high risk activities. This trend suggests that for the HSS group of adolescents, the influence of peers may play a role in their motives to either initiate involvement or maintain involvement in high risk activities. Another possibility may be that high risk individuals seek out others with similar tendencies.

The finding that the HSS group perceived greater benefits than risks for engaging in high risk activities supported findings by Bentin et al. (1993) and those by Parsons et al. (2000) who reported that adolescents are more driven by perceptions of positive benefits associated with risk behaviour rather than knowledge of the costs or dangers involved in risk taking. But are the high risk adolescents entertaining a personal fable of uniqueness and invulnerability to risk? A decision making perspective offers an alternate explanation. According to Kahneman and Tversky's (1972, 1984) "prospect theory" in decision making, individuals select the option which has the greatest subjective expected utility to maximize one's well-being. However, an alternate decision making explanation proposed by Lopes (1987) suggests that risk takers focus on the potential gains of behaviour and pay little attention to the potential for loss while risk avoiders tend to focus on the potential for loss. Thus, according to Lopes (1987), the focal point for high risk adolescents to engage in a high risk activity may be its potential for gains or benefits rather than its potential for loss or risk. When predicting life events, the HSS group believed they were less likely to experience positive events in the future. Are the HSS group of students more realistic? Their low optimism parallels findings by Pyszczynski et al. (1987) who found that depressed individuals show fewer optimistic biases in their probability estimates than non-depressed individuals. These findings suggest a need for further investigation and an exploration of depression among high risk adolescents. Thus, the HSS group of students with multiple suspensions reported high risk involvement, low risk perception, and low optimism in relation to their future.

The two groups of students also shared some commonalities on their perceptions of risk where the mean differences were quite small. For example, the knowledge subscale had the highest overall means for both groups of students across both primary and secondary risk activities indicating that participants believed that the risks associated with these activities are generally well known to them. This finding has implications for the validity and efficacy of educational programmes which focus on knowledge based information to raise awareness of risk. The avoidability subscale also had high overall means across both primary and secondary risk activities. Although participants thought that risks associated with all seventeen activities were well known and could be avoided, they believed primary risk activities were slightly more avoidable and their risks better known than socially desirable activities with elements of risk. The overall means on the personal control subscale for primary and secondary risk activities did not differ greatly suggesting that once engaged in these activities, participants believed they were somewhat equally able to control the risks or dangers for all seventeen activities.

Future Oriented Optimism

On the future life events inventory, when predicting the occurrence probability of positive future life events, the LSS group of students believed they had a greater chance of experiencing positive life events in the future. However, the construct of perceptual biases is problematic (Ditto & Lopes, 1992; Harvey, 1992; Weinstein, 1980). Are students in the LSS group exhibiting a future oriented optimistic bias which is warranted given that they had low level suspensions, reported low risk involvement, and demonstrated a greater awareness of risk behavior perceptions? Or, are they exhibiting an optimistic bias in their calibrations by overestimating their chances of experiencing positive future life events (e.g. being popular, winning awards, getting on the honour roll, graduating, getting a driver's licence, having a steady boy/girlfriend, getting a good job with a high salary after graduation etc.)? According to Weinstein (1980), if an event is perceived as controllable and if an individual has a commitment or emotional investment in the outcome, an

optimistic bias may occur because individuals bring to mind factors which would increase the likelihood of the event.

Students in the HSS group, however, tended to view their own future probability of experiencing positive life events less optimistically. Are the HSS group of students more realistic in assessing their future probability of positive events given their high levels of involvement in risk activities and generally low risk behaviour perceptions? Or, are these findings related to the participants' knowledge and ability to use cost-benefit reasoning and base rate reasoning in real life decision making? If relationships exist among the participants' self-reported measures and performance on rational thinking tasks, it would provide further evidence of a syndrome of problem behaviour because strong associations between the tasks would suggest that the same students are showing similar profiles.

Interestingly, the LSS and HSS groups of students did not differ significantly in their perceived probabilities of experiencing negative future life events, but both groups predicted that others would have a greater chance of experiencing bad things in the future. These findings support those by Klaczynski and Fauth (1995) who found that most individuals, regardless of their personal qualities, tend to view their own futures more positively and more optimistically than the futures of their peers. Klaczynski and Fauth (1995) suggested that inflated estimates of the perceived likelihood of negative future life events for others supports the availability heuristic and an insensitivity to the base rates at which various undesirable events occur by overestimating the probabilities for others (e.g. contracting AIDS, developing cancer, being fired from a job). Thus, with respect to negative future life events, both the LSS and HSS groups of students may be exhibiting a future oriented optimistic bias.

Reasoning Tasks

How did the two groups of students perform on the two rational thinking behaviour tasks which simulated real-life decision making? An examination of performances on the

gambling task of cost-benefit reasoning provided some findings which further differentiated the two groups of students. The HSS group of students tended to draw more from the disadvantageous decks. Although both groups initially sampled cards from all decks, the HSS group of students tended to return more frequently to the disadvantageous deck B and the combined disadvantageous decks A + B during their last 50 trials. These patterns and trends suggested that the HSS group of students displayed a preference for choices that yielded high immediate rewards or gains in spite of higher future penalties or losses. Unfortunately, the HSS group of students' cost-benefit reasoning on the gambling task resulted in monetary net losses because their choices of decks were disadvantageous in the long run.

Participants approached the gambling task with much enthusiasm. At the end of the game, participants were asked what they would do differently if they were to play the game again. Some of the comments made by students in the HSS group are noteworthy given that as a group they tended to select more often from the disadvantageous decks. For example, after receiving a \$12.50 penalty from deck B during the game, one student said, "This is kinda scary. I don't want to see another one like that!" This student, however, returned to deck B several times. When asked what he would do differently, the student indicated that he would stay away from deck B and pick more cards from deck A (this was the other disadvantageous deck). Another student said, "I'm using my instincts now. I don't trust that pile! I hate it! (i.e. deck B). However, this student selected cards from the disadvantageous deck B three more times and received some heavy penalties as a result. At the end of the game, the student stated that he would stay away from deck B and pick more cards from decks C and D (these were advantageous decks). These comments are reflective of the students' heightened state of emotional arousal throughout the gambling task of cost-benefit reasoning.

The second rational thinking task tapped the participants' statistical reasoning through the use of base rate information when making decisions on a game of chance

(marble task). In contrast to the gambling task of cost-benefit reasoning, no differences were obtained between the high and low risk adolescents on the marble task of statistical reasoning. It was expected that the high risk group of adolescents (i.e. HSS group) would perform worse on this task than the low risk group of adolescents (i.e. LSS group). However data showed that group differences across all trials on this task were quite small. The implications of these findings are that some reasoning skills may be intact or well developed in the high risk group of adolescents. For example, no cognitive ability differences between the two groups suggests that the HSS group of students have the capability to do well on some tasks, specifically on the marble task of statistical reasoning.

The finding that both groups of adolescents performed poorly on the marble task of statistical reasoning parallels findings by Denes-Raj and Epstein (1994) who designed this relatively simple, practical decision making task. According to cognitive-experiential self-theory (CEST), behaviour is guided by the joint operation of two modes of reasoning: an experiential (intuitive) mode which is more responsive to absolute numbers than ratios; and a cognitive (rational) mode which exhibits an opposite pattern in that it is more responsive to ratios than absolute numbers (Denes-Raj & Epstein, 1994). The marble task of statistical reasoning placed the cognitive-experiential modes of reasoning into direct conflict. Both groups of adolescents in this investigation tended to behave according to their experiential-intuitive mode even though they were fully aware that it was irrational. Denes-Raj and Epstein (1994) explain this decision making behaviour by suggesting that an individual's experiential (intuitive) system can override the cognitive (rational) system even when people are fully aware that the resultant behaviour is irrational.

In summary, descriptive profiles of the high risk sample of adolescents in this study suggest an at-risk group of adolescents who displayed tendencies toward feelings of invulnerability to future risky consequences. A general disregard of future consequences may prevent a person from feeling vulnerable to risk (Strathman et al., 1994). According to Furby and Beyth-Marom (1992), how we interpret risk taking behaviour in adolescents

may impact on social policy and educational programmes designed to curb risk taking. Are the high risk adolescents entertaining a personal fable of invulnerability reflecting Elkind's (1967) theory of adolescent egocentrism as a cognitive deficiency whereby they overdifferentiate their thoughts and feelings from others? Or, are they making judgment errors by underestimating the likelihood of negative outcomes when making decisions (Bell & Bell, 1993)? According to Baron (1985, 1988), judging the probability of adverse outcomes and the tendency to underestimate one's own risk relative to that faced by others points toward a judgment error. That the high risk group of adolescents were also the high risk choosers on the cost-benefit reasoning task suggests an insensitivity to future consequences. According to Damasio (1994, 1996), and Bechara et al. (1994, 2000), the roles of emotions and arousal in cost-benefit reasoning may impact on decision making. The results on the gambling task in the current investigation suggest a need to look beyond traditional explanations of risk taking behaviour.

Do Intercorrelations Among Tasks Support a Syndrome of Problem Behaviour?

The results in this investigation displayed some consistent trends suggesting that high risk adolescents perceived less risk, were less optimistic, and performed more poorly on the cost-benefit reasoning task. Do these trends support a syndrome of problem behaviour? Some support was found, in particular with the measures taken from the literature. For example, the finding that 51 out of 66 correlations among specific primary and secondary risk activities were positive points toward a syndrome of problem behaviour suggesting that risk activities tend to be intercorrelated. That is, engagement in one high risk activity is associated with involvement in other high risk activities. Further, it was the high suspension adolescents who reported engaging more often in high risk activities. These relationships support previous work in the literature on risk behaviour in adolescence (Benthin et al., 1993; Jessor, 1984, 1987; Jessor & Jessor, 1977; Jessor et al., 1991).

What are the implications that the two reasoning tasks were not found to be correlated with the self-report measures? This was somewhat more problematic in the case

of the gambling task. Results suggest that those who displayed low risk perception were not the same individuals who displayed a poor performance on the gambling task of cost-benefit reasoning. But overall, we do know that it is the high risk adolescents who displayed low risk perception and poor performance on the gambling task. Are there perhaps two subgroups of adolescents within the high risk group of adolescents? One can speculate on the possibilities that the existence of subgroups within the high risk group might be characterized or differentiated by such aspects as specific risk perception subscales, involvement in specific risk activities, performance on reasoning tasks (i.e. those who had drawn from disadvantageous decks on the gambling task, but reported at the end of the game that they would choose the advantageous decks if the game were played again), personal or social values, moral reasoning etc. The data set in this study, however is limited in examining these hypotheses. Future research in the area of adolescent risk taking behaviour should consider these hypotheses.

Can Performance on Risk Related Measures be Explained by Individual Differences in Cognitive Ability and Thinking Styles?

Few differences were obtained between the HSS and LSS groups on the individual difference measures. Overall, cognitive ability did not discriminate the high and low risk adolescents, and cognitive ability played only a minor role in performances on the different tasks. Interestingly, results showed a small trend associating cognitive ability and positive future life events suggesting a trend supported in the literature that more intelligent adolescents view their futures more positively and optimistically than those of their peers (Klaczynski & Fauth, 1995; Nurmi & Pulliainen, 1991).

That cognitive ability did not discriminate the two groups of adolescents supports the need to broaden the scope of adolescent risk taking and risk behaviour perception to incorporate an investigation of thinking dispositions as cognitive styles. A generic model of human thought suggested by Baron (1985, 1988) and advanced by Stanovich (1999) and Stanovich and West (1998, 2000) distinguishes between cognitive capacities as

traditionally measured on I.Q. tests and thinking dispositions or cognitive styles as learned tendencies to behave in certain ways. According to Stanovich (2001), "there is increasing attention being paid to behavioural/cognitive concepts that reside at the borderline of cognitive psychology and personality" (p.6). Further, Stanovich (2001) posits "that thinking dispositions can predict performance on reasoning and rational thinking tasks even after individual differences in cognitive ability have been partialled out" (p.7).

Individual difference in thinking dispositions were implicated in this investigation including actively open-minded thinking, paranormal beliefs, the consideration of future consequences, and the deliberation of outcomes. Although significant differences were not obtained, the trends provide interesting patterns for speculation. Those who displayed a greater awareness of risk perception were more likely to engage in actively open-minded thinking, more likely to consider the future consequences for their present behaviour, and more likely to deliberate the possible outcomes of certain actions. These findings were consistent with a descriptive profile of the low risk group of adolescents.

High risk adolescents were less likely to engage in actively open-minded thinking, a disposition which facilitates a willingness to change one's beliefs in the face of contradictory evidence (Stanovich & West, 1998, 2000). This finding supports studies which have found high risk teens to demonstrate a confirmation bias in evidence seeking (Benthin et al., 1993; Klaczynski & Fauth, 1995; Lavery et al., 1993; Quadrel et al., 1993). That the high risk group of adolescents were more likely to embrace a disposition of paranormal beliefs supports findings in the literature that a high belief in external control contributes to problem behaviour in adolescents (Jessor et al., 1991). High risk adolescents were also less likely to consider the future consequences for their present behaviour and less likely to deliberate possible outcomes of their actions. As thinking dispositions, these findings suggest high risk adolescents are vulnerable to risk when making decisions about whether to engage in risky activities.

The conceptualization of egocentrism has eluded consistency in the literature and is in need of a better construct development (Frankenberger, 2000; Greene et. al., 2000). The two groups of adolescents in the present study did not differ significantly when compared on the New Personal Fable scale as a disposition toward feelings of invulnerability and omnipotence. This investigation does not support a personal fable of invulnerability and omnipotence as a discerning personality feature between the two groups of adolescents. Also, the range of this scale is from 0-66 and ratings for both groups were 45.37 and 46.33 which is mid-range, further not supporting a personal fable of invulnerability hypothesis. The lack of support for a personal fable construct of invulnerability comparing adolescents and adults suggests that this widely-held belief of adolescents may be based on folk psychology rather than empirical research (Beyth-Marom et al., 1993; Furby & Beyth-Marom, 1992). In fact, Lavery and Siegel (1993) found that egocentrism measures were not significantly related to risk involvement or risk and behaviour perceptions. However, studies have found high risk teens or those identified with conduct disorders to show a disposition toward feelings of invulnerability (Benthin et al., 1993; Klaczynski & Fauth, 1995; Lapsley et al., 1986; Quadrel et al., 1993). While the high and low risk adolescents in this study were not differentiated by entertaining a personal fable of invulnerability, it is possible that different high risk subgroups of adolescents exist within the overall high risk group.

The implication for understanding risk in adolescence is that it is not competence or computational limitations that inhibit poor risk perception and poor consideration of future consequences. This is speculative, however and results showed non significant trends thus requiring further study. The implicated role of these dispositions (i.e. actively open-minded thinking, consideration of future consequences, deliberation, and paranormal beliefs) suggest that these differences may at least be partially explained by thinking styles and the beliefs that emerge from these different styles. One implication for interventions is that these perceptions and reasoning can be remediated given that they are learned

tendencies to behave in certain ways. Interestingly, some researchers have noted that several programmes to curb risk taking behaviour in adolescents have emphasized social skills and life skills, but focus on teaching how to behave from the perspective of adult society rather than teaching critical thinking skills in learning how to decide using cost-benefit reasoning and probability reasoning (Beyth-Marom et al., 1991; Paul & Elder, 2000; Weinstein, 2000)

Why do High Risk Adolescents Engage in Risk Behaviour?

Models of Reasoning

The students with multiple suspensions in this study displayed interesting parallels to patients with damage in the ventromedial prefrontal cortex studied by Bechara et al. (1994, 2000). Like the prefrontal lobe patients, the HSS group of students displayed no deficits in intelligence when compared to the group of students with low level suspensions. Nevertheless, they displayed significantly suboptimal performance on the cost-benefit reasoning task. Although the effect was smaller than that shown by patients studied by Bechara et al. (1994), it was equal in size to that displayed by the heroin addicts studied by Petry et al. (1998). These patterns of performance on a task which probed the participants' sensitivity to consequences through cost-benefit reasoning are explained using a somatic marker hypothesis (Bechara et al., 1994, 2000) and a generic dual process framework for reasoning performance (Stanovich, 1999; Stanovich & West, 1998, 2000).

Bechara et al. (1994) and Damasio (1996) suggest that inadequate somatic marking might underlie behavioural problems and behavioural regulation. The somatic marker hypothesis allows one to conceptualize two different forms of irrationality based on differing relationships between the emotions and controlled and strategic cost-benefit reasoning. In contrast to folk psychology which views emotions as disruptive and interfering with rational thought, recent work in the cognitive sciences conceptualizes emotions as having adaptive regulatory powers. On the rationality of emotions, Johnson-Laird and Oatley (1992) conceptualized emotions as interrupt signals supporting goal

achievement. They see emotions as intentional-level constructs of systems whose behaviour is governed by neither fixed action patterns nor rationality. This view of emotions underlies the somatic marker hypothesis (Bechara et al., 1994, 2000). The basic idea is that emotions serve to stop the "combinatorial explosion of possibilities that would occur if an intelligent system tried to calculate the utility of all possible outcomes" (Stanovich & West, 2000). Thus, emotions are thought to constrain the possibilities to a manageable number based on somatic markers stored from similar situations in the past. The two contrasting views of emotions (i.e. folk psychology and cognitive sciences) may be explained by a generic dual process framework for reasoning performance described by Stanovich (1999) and Stanovich and West (1998, 2000). This framework proposes two structured cognitive processing systems which house separate goal structures and separate mechanisms to implement the goal structures. System 1 is reflective of heuristic processing and is described by Stanovich (1999) as automatic, largely unconscious, and relatively undemanding of computational capacity. System 2, on the other hand, encompasses processes of analytic intelligence as traditionally measured on intelligence tests. Bechara et al.'s (1994) discussion of the role of emotions and the somatic marker hypothesis maps well onto System 1 heuristic processes in Stanovich's (1999) framework.

Stanovich (1999) emphasizes the work of Pollock (1991) as being relevant to the role of somatic markers. Briefly, Pollock (1991) identifies System 1 heuristic processes as composed of Q&I (i.e. quick and inflexible) modules that perform specific computations. System 2 processes refer to reasoning in practical rationality. The Q&I module for computation is an accurate one, but relies on certain assumptions about the structure of the world. As Stanovich (1999) explains it, when these assumptions are violated, then the module must be overridden by System 2 analytical processes. Emotions also have a role in this model by supplementing Q&I modules for practical reasoning in social situations. As an example, Pollock (1991) explains that being afraid of tigers may initiate quick avoidance responses without needing to think about it.

According to several theorists in the field of cognitive sciences, there are two ways in which the rational regulation of behaviour may go awry i.e. an override failure and a module failure (Damasio, 1994; Johnson-Laird & Oatley, 1992; Pollock, 1991; Stanovich, 1999; Stanovich & West, 1998, 2000). For example, an override failure may occur when the emotions of a Q&I practical reasoning module are too pervasive and must be overridden by the controlled analytical processing of System 2. Behavioural regulation can also go awry if the Q&I modules might be missing or might malfunction. In this case, "the automatic and rapid regulation of goals is absent and System 2 is faced with a combinatorial explosions of possibilities because the constraining function of the emotions is missing" (Stanovich, 1999). Thus, behavioural regulation may go awry because there are too few emotional signals to help prioritize goals for action. Why do high risk adolescents engage in risk behaviour? Perhaps a more important question is why do some high risk adolescents continue engaging in risk behaviour? A somatic marker hypothesis (Bechara et al., 1994) and a generic dual process framework for reasoning performance (Stanovich, 1999; Stanovich & West, 1998, 2000) were used to address these perplexing questions. Is behaviour sustained because the Q&I modules of System 1 (heuristic) are either missing or malfunctioning (i.e. failing to inhibit) as suggested by the somatic marker hypothesis? Or, is it a failure of System 2 (analytic) to override System 1 (heuristic) as suggested by the generic dual process framework?

The verbal protocols from participants in the HSS group demonstrated that losses were very salient to them, suggesting that Q&I modules are playing a role by signaling that a bad outcome has occurred. A lack of cognitive ability differences between the LSS and HSS groups suggests that in terms of computational limitations, both groups have the same amount of cognitive resources to override a System 1 heuristic response. However, the overall trends with thinking dispositions suggest important differences between the LSS and HSS groups. There is some evidence that in terms of dispositions, the HSS group of students may be less able to override the System 1 heuristic response because of

behavioural regulation styles displayed by lower propensities toward actively open-minded thinking, deliberation of outcomes, and the consideration of future consequences as personality and thinking dispositions.

The parallel in the performance patterns on the gambling task between the high risk students in this study and the patients studied by Bechara et al. (1994, 2000) suggests that inadequate somatic marking might underlie the poor choices made by the HSS group of students in their cost-benefit reasoning. Thus, another explanation of poor performance on the gambling task by the HSS group of students may be a malfunction in the System 1 heuristic response. That is, risk behaviour may be sustained because when under extreme conditions of intense emotional arousal as demonstrated on the gambling task of cost-benefit reasoning, the Q&I modules of the System 1 heuristic process malfunctioned by failing to inhibit behavioural regulation (Bechara et al., 2000). Further research in these areas are necessary to advance our understanding of why some individuals (both adolescents and adults) continue to engage in high risk behaviour which may have detrimental effects on their overall well-being. Indeed, Bechara et al. (2000) note that recent studies have indicated that impairment in decision making may be at the core of the problem of substance abuse. Further studies need to examine judgments across a wide array of subjects (e.g. those with depression, attention deficit/hyperactivity disorder, conduct disorder, other psychiatric disorders, gambling and substance addictions) and to explore decision making processes in terms of mood, affect, social values, moral reasoning, and the rationality of emotions to better understand the roles of a somatic marker hypothesis and a generic dual process framework as models of reasoning (Bechara et al., 2000; Goff et al., 2000; Johnson-Laird & Oatley, 1992; Kuther et al., 2000; Stanovich & West, 1998, 2000). These findings suggest some interesting implications for interventions which need to reflect the interplay of thoughts, feelings, and emotions as decision making occurs in real-time (Lavery et al., 1993; Moore & Parsons, 2000).

Limitations of the Present Study

The present study was exploratory in nature and results or trends cannot be generalized. The many individual analyses that are a consequence of examining a diverse and complex set of tasks are recognized as a limitation. One clearly loses statistical power as the number of contrasts increase (Kirk, 1982). Importantly, the primary goal of this research project was to study together a variety of self-report and rational thinking behaviour tasks that have typically been studied in isolation and in separate literatures. Despite these complexities, the analytic strategy used in this study was helpful to discern overall trends and patterns reflected in the data to both compare the high and low risk groups of students on a variety of tasks and to explore potential associations among the tasks.

A second limitation is the restrictive selection of participants all of whom were male adolescents and drawn from one metropolitan high school. A wider range of participants should be considered for further study including adults for comparative purposes and female adolescents. The inclusion of females, however would necessitate a re-structuring of the risk perception questionnaire in relation to risk taking behaviours and activities to ensure that items were not gender specific or based on gender stereotypes. Two recent studies have devised instruments which may have promise in this area and should be considered in future research (Gullone & Moore, 2000; Shapiro, Siegel, Scovill, & Hays, 1998). In relation to the selection of participants, a second limitation was that only two subgroups of adolescents were examined in this study especially given that few significant differences were found on the risk perception and thinking dispositions questionnaires. The addition of a more extreme subgroup of adolescents (e.g. those who had been expelled from school or were in a detention centre etc.) would have provided for some interesting comparisons.

Third, the inclusion of only one task which probed the participants' statistical reasoning using base rate information was a limitation. Given that results from the marble

task were limited, a second statistical reasoning task would have provided additional data to differentiate the two groups of adolescents. The marble task devised by Denes-Raj and Epstein (1994) as a game of chance did not work as expected in this investigation, possibly because it immediately followed the gambling task which the participants found highly motivating. As well, since there were no significant differences on cognitive ability measures, the marble task may not have differentiated the two groups because both groups of students possessed similar cognitive power reflected in their use of base rate information on the marble task of statistical reasoning. Future studies should include more than one statistical reasoning task and carefully consider the placement of the marble task in the overall sequence of administration of tasks.

Another limitation of the present study was the small number of items on several tasks which were used to calculate pertinent variables. Some tasks may have benefited through the addition of more items (e.g. the impulsivity and the New Personal Fable subscales of the thinking dispositions questionnaire). However, without dropping some tasks from the study, this would have resulted in testing sessions that were too long for the participants. Future studies could benefit from the addition of self report measures on depression, mood or emotions, and social or moral reasoning to further differentiate various subgroups of adolescents.

The results of the present investigation advances our understanding of adolescents' tendency to engage in risky behaviour which should theoretically translate into an effective intervention programme. The high risk adolescents in this study reported high involvement in risky activities, displayed a low awareness of risk behaviour perceptions, were less optimistic about their future, and emerged as the high risk choosers on the gambling task thus displaying less sensitivity to consequences. Although the two groups of adolescents did not differ on general cognitive ability, the high risk adolescents displayed a propensity toward paranormal beliefs and were less likely to embrace a disposition of actively open-minded thinking. There is a critical need to base interventions on empirical evidence rather

than folk psychology (Furby & Beyth-Marom, 1992; Moore & Parsons, 2000).

Interventions from a decision making perspective need to analyze association based errors such as perceived cost-benefits and match a training technique or teaching strategy to the specific judgment error (Arkes, 1991). The rationale for educational interventions to change thinking dispositions derives from an assumption in the cognitive psychology literature that actively open-minded thinking dispositions make the individual a more rational person in decision making (Stanovich, 2001). According to Stanovich (2001), there is a growing body of empirical evidence showing that people who are high in actively open-minded thinking tend to give the normative response on hypothesis testing and reasoning tasks, to avoid belief bias in their reasoning, and to properly calibrate beliefs to the state of evidence. Given that certain high risk activities which are detrimental to one's well-being have remained high despite efforts to reverse such trends (Irwin, 1993), there is a critical need to broaden interventions which directly address a person's thinking styles (Halpern, 1998; Sternberg & Grigorenko, 1997). The trends observed with the thinking dispositions in the current study suggest that thinking dispositions which are more malleable and amenable to remediation should be explored in future studies of risk taking behaviour by adolescents. Interventions need to be based on empirical evidence rather than folk psychology as according to Quadrel et al. (1993), misdiagnosing the sources of risk taking behaviour could result in denying adolescents' their deserved freedoms, failing to provide needed assistance, and viewing them as a societal problem rather than a resource.

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Appendix A

Risk Perception Questionnaire

1. How many times have YOU done this activity in the past 6 months?

	None	Once or Twice	3-5 Times	More Than 5
Drinking (e.g. wine,beer,liquor)	1	2	3	4
Getting drunk	1	2	3	4
Smoking cigarettes	1	2	3	4
Riding a bicycle	1	2	3	4
Using marijuana	1	2	3	4
Taking drugs (coke, crack etc.)	1	2	3	4
Swimming	1	2	3	4
Riding with drunk driver	1	2	3	4
Riding/driving without seatbelt	1	2	3	4
Having unprotected sex	1	2	3	4
Playing contact sports	1	2	3	4
Shoplifting/stealing	1	2	3	4
Using skateboard/rollerblades	1	2	3	4
Fighting (physical)	1	2	3	4
Damaging property/vandalism	1	2	3	4
Cutting class/school	1	2	3	4
Riding a motorcycle	1	2	3	4

2. How many times do you think that PEOPLE YOUR AGE (same sex) have done this activity in the past 6 months?

- list of activities and scales for each of the following questions

3. How well do you know about the risks or dangers of this activity?

N.B. - list of activities with the following scale

Not Well Known							Very Well Known
1	2	3	4	5	6	7	

Appendix A (continued)

4. To what extent can you avoid doing this activity?

Cannot Be Avoided							Can Be Avoided
1	2	3	4	5	6		7

5. If you did this activity, to what extent could you control the risks or dangers?

Risks Cannot Be Controlled							Risks Can Be Completely Controlled
1	2	3	4	5	6		7

6. How much are you influenced by your peers to do this activity?

Not At All Influenced							Greatly Influenced
1	2	3	4	5	6		7

7. Do you fear the possible risks or dangers of this activity?

No Fear At All							Great Deal Of Fear
1	2	3	4	5	6		7

8. If you did this activity, do you believe that you would get hurt?

Not At All							Very Much
1	2	3	4	5	6		7

9. If someone your age (same sex) did this activity, do you believe that he/she would get hurt?

Not At All							Very Much
1	2	3	4	5	6		7

10. Are the benefits or pleasures of doing this activity greater than the risks or dangers?

Risks Much Greater							Benefits Much Greater
1	2	3	4	5	6		7

11. If you DON' T do this activity, could there be negative consequences from your peers?

No, There Couldn't							Yes, There Could
1	2	3	4	5	6		7

Appendix B

Future Life Events Inventory

Compare yourself to other students (same sex) in your school.

How strongly do you expect that these events will happen to you ?

Circle one point on the scale beside each item.

I am
Sure It Will
NOT
Happen

Even
Chance
"Fift-Fifty"

I am
Sure It
WILL
Happen

1. Graduating from high school with a 4 year diploma before you are 19 years old

0 10 20 30 40 50 60 70 80 90 100

2. Getting your driver's licence before leaving high school.
3. Having good enough grades to go on to college or university if you want to.
4. Having a steady boyfriend/girlfriend for more than 4 weeks.
5. Getting on the honour roll this year.
6. Being one of the most popular kids in your class.
7. Getting a good job with a high salary after graduating from high school, community college, or university.
8. Winning an award or being recognized for an accomplishment by your school.
9. Being thought of as a best friend by several kids in school.
10. Enjoying your first job after graduating from high school, community college, or university.
11. Getting divorced.
12. Not finding a job within 6 months of graduating from high school, community college, or university.
13. Being fired from a job.
14. Dropping out of high school.

Appendix B (continued)

15. Being arrested.
16. Contracting AIDS.
17. Being a victim of mugging or burglary.
18. Developing cancer.
19. Being laid off from a job.
20. Contracting a venereal disease (VD).
21. Being injured in an auto accident.
22. Requiring treatment for a drug/alcohol problem.
23. Having a house in which you are living burn down.

Now, think of other students (same sex) in your school.

How strongly do you expect that these events will happen to other students in your school ?

Circle one point on the scale beside each item.

- same questions and same scale

Gambling Game Score Card

RESPONSE OPTION	DECK A (+1.00)	DECK B (+1.00)	DECK C (+.50)	DECK D (+.50)
1				
2				
3	- 1.50		-.25	
4				
5	- 3.00		-.75	
6				
7	- 2.00		-.25	
8				
9	- 2.50	- 12.50	-.75	
10	- 3.50		-.50	- 2.50
1				
2	- 3.50		-.25	
3			-.75	
4	- 2.50	- 12.50		
5	- 2.00			- 2.50
6				
7	- 3.00		-.25	
8	- 1.50		-.75	
9				
10			-.50	
1		- 12.50		- 2.50
2	- 3.00			
3				
4	- 3.50		-.50	
5			-.25	
6	- 2.00		-.50	
7	- 2.50			
8	- 1.50			
9			-.75	
10			-.50	
1	- 3.50			
2	- 2.00	- 12.50		- 2.50
3	- 2.50			
4			-.25	
5			-.25	
6				
7	- 1.50		-.75	
8	- 3.00			
9			-.50	
10			-.75	
1		- 12.50		- 2.50
2	- 3.00			
3				
4	- 3.50		-.50	
5			-.25	
6	- 2.00		-.50	
7	- 2.50			
8	- 1.50			
9			-.75	
10			-.50	

REWARDS: DECK A = ___ DECK B = ___ DECK C = ___ DECK D = ___ TOTAL NET
 PENALTIES: DECK A = ___ DECK B = ___ DECK C = ___ DECK D = ___ GAIN OR LOSS = ___

Appendix D

Thinking Dispositions

Disagree Strongly 1	Disagree Moderately 2	Disagree Slightly 3	Agree Slightly 4	Agree Moderately 5	Agree Strongly 6
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Actively Open-Minded Thinking (AOT)

The AOT subscale consists of ten items.

Four items tap a disposition toward reflectivity.

1. If I think longer about a problem, I will be more likely to solve it.
2. Difficulties can usually be overcome by thinking about the problem, rather than waiting for good fortune.
3. Intuition is the best guide in making decisions (reverse scored).
4. Coming to decisions quickly is a sign of wisdom (reverse scored).

One item taps a willingness to consider evidence contradictory to beliefs.

5. People should always take into consideration evidence that goes against their beliefs.

Two items tap a willingness to consider alternative opinions and explanations.

6. A person should always consider new possibilities.
7. Considering too many different opinions often leads to bad decisions (reverse scored).

Three items tap a tolerance for ambiguity combined with a willingness to postpone closure.

8. There is nothing wrong with being undecided about many issues.
9. Changing your mind is a sign of weakness (reverse scored).
10. Basically, I know everything I need to know about the important things in life (reverse scored).

Appendix D (continued)**Counterfactual Thinking (CounterF)**

The Counterfactual thinking subscale consists of two items.

11. My beliefs would not have been very different if I had been raised by a different set of parents (reverse scored).
12. Even if my environment (family, neighbourhood, schools) had been different, I probably would have the same religious views (reverse scored).

Paranormal Beliefs (Para)

This Paranormal beliefs subscale consists of six items. The items are similar to the superstition subscale of a paranormal beliefs questionnaire developed by Tobacyk and Milford (1983) and used by Stanovich and West (1995).

Two items tap a belief in astrology.

13. It is advisable to consult your horoscope daily.
14. Astrology can be useful in making personality judgments.

Four items tap a belief in the concept of luck.

15. I have personal possessions that bring me luck at times.
16. The number 13 is unlucky.
17. It is bad luck to have a black cat cross your path.
18. Opening an umbrella indoors will increase one's chances of misfortune in the near future.

These items are similar to the superstition subscale of a paranormal beliefs questionnaire developed by Tobacyk and Milford (1983) and used by Stanovich and West (1995).

Appendix D (continued)**NEO Taxonomy Scale N5: Impulsiveness (Impulse)**

An eight item subscale of the NEO Taxonomy scales from Costa and McCrae (1992) specifically taps a disposition toward impulsive behaviour.

19. I rarely overindulge in anything (reverse scored).
20. I have trouble resisting my cravings.
21. I have little difficulty resisting temptation (reverse scored).
22. When I am having favourite foods, I tend to eat too much.
23. I seldom give in to my impulses (reverse scored).
24. I sometimes eat myself sick .
25. Sometimes I do things on impulse that I later regret.
26. I am always able to keep my feelings under control (reverse scored).

NEO Taxonomy Scale C6: Deliberation (Delib)

An eight item subscale of the NEO Taxonomy scales from Costa and McCrae (1992) specifically taps the participants' tendency toward the deliberation of outcomes.

27. Over the years, I've done some pretty stupid things (reverse scored).
28. I think things through before coming to a decision.
29. Occasionally I act first and think later (reverse scored).
30. I always consider the consequences before I take action.
31. I often do things on the spur of the moment (reverse scored).
32. I rarely make hasty decisions.
33. I plan ahead carefully when I go on a trip.
34. I think twice before I answer a question.

Appendix D (continued)**NEO Taxonomy Scale 05: Ideas (OIdeas)**

An eight item subscale of the NEO Taxonomy scales from Costa and McCrae (1992) taps a propensity toward ideas which reflect cognitive interests.

35. I often enjoy playing with theories or abstract ideas.
36. I find philosophical arguments boring (reverse scored).
37. I enjoy solving problems or puzzles.
38. I sometimes lose interest when people talk about very abstract, theoretical matters (reverse scored).
39. I enjoy working on 'mind-twister' type puzzles.
40. I have little interest in speculating on the nature of the universe or the human condition (reverse scored).
41. I have a lot of intellectual curiosity.
42. I have a wide range of intellectual interests.

Social Desirability Response Bias (SDesire)

Five items reflecting social desirability as a response bias are taken from Erwin's (1981, 1983) Scale of Intellectual Development (SID) and used by Stanovich and West (1995).

43. I always put forth my best effort.
44. I am always trustworthy and truthful.
45. I never disagree with other people.
46. I always think through problems thoroughly.
47. I never mislead people.

Appendix D (continued)**Consideration of Future Consequences (CFC)**

The CFC subscale devised by Strathman et al. (1994) consists of 11 statements which tap an individual's consideration of future consequences for present behaviours.

48. I think about the future and try to influence it with my day to day behaviour.
49. I often do things to achieve outcomes (goals) that may not happen for many years.
50. I only act to satisfy my immediate concerns because I figure the future will take care of itself (reverse scored).
51. My behaviour is only influenced by the immediate (in a few days) results of my actions (reverse scored).
52. I am willing to give up my immediate happiness or well-being to get something I want in the future.
53. It is important to take warnings about negative consequences seriously, even if they will not happen for many years.
54. It is more important to do something with important future consequences than doing something with less-important immediate consequences.
55. I generally ignore warnings about possible future problems because I think the problems will get resolved before they reach a crisis (reverse scored).
56. Sacrificing now is usually not necessary since future outcomes can be dealt with at a later time (reverse scored).
57. I only do things to satisfy my immediate concerns because I will take care of future problems at a later date (reverse scored).
58. The specific results of my day to day work are more important to me than behaviour with results in the future (reverse scored).

Appendix D (continued)**New Personal Fable Scale (NPFS)**

Eleven items are taken from the New Personal Fable Scale devised by Lapsley et al.(1989) to assess a disposition toward entertaining a personal fable.

Three items tap personal uniqueness:

- 59. No one has the same thoughts and feelings that I have.
- 60. I'm somehow different from everyone else.
- 61. Nobody will ever know what it's like being me.

Four items tap omnipotence:

- 62. I believe that I can do anything I set my mind to.
- 63. I believe that no one can stop me if I really want to do something.
- 64. I think I am a powerful person.
- 65. I think that I am better than my friend at just about anything.

Four items tap invulnerability:

- 66. Nothing seems to bother me.
- 67. I can get away with things that other people can't.
- 68. I am not afraid to do dangerous things.
- 69. It is easy for me to take risks because I never get hurt.

Appendix E

Mean Scores of the Low Suspension Students (N=63) and High Suspension Students (N=27) in Self-reported Risk Involvement Across Specific Primary and Secondary Risk Activities

Variable	LSS	HSS	t (88)
<u>Primary Risk Activities</u>			
Drinking alcohol	2.33 (1.19)	2.74 (1.06)	-1.54
Getting drunk	1.54 (.93)	2.00 (1.07)	-2.05 *
Smoking cigarettes	1.57 (1.06)	2.85 (1.38)	-4.79 **
Using marijuana	1.37 (.87)	2.19 (1.30)	-3.51 **
Taking drugs	1.02 (.13)	1.44 (.934)	-3.59 **
Riding with drunk driver	1.18 (.53)	1.30 (.61)	-0.96
Ride/drive-with no seatbelt	1.97 (1.18)	1.93 (1.04)	0.16
Having unprotected sex	1.14 (.57)	1.41 (.89)	-1.70
Shoplifting/stealing	1.30 (.66)	1.33 (.56)	-0.22
Fighting	1.78 (.94)	2.19 (1.00)	-1.85
Damage property/vandalism	1.43 (.80)	1.67 (.83)	-1.28
<u>Secondary Risk Activities</u>			
Riding bike	3.00 (1.24)	2.85 (1.20)	0.52
Swimming	2.16 (1.14)	2.41 (1.22)	-0.93
Playing sports	2.92 (1.11)	2.70 (1.20)	0.83
Skating/rollerblading	2.08 (1.29)	2.11 (1.16)	-0.11
Cutting school	1.76 (.86)	2.52 (1.12)	-3.49 *
Ride motorcycle	1.40 (.93)	1.48 (.94)	-0.40

Note: LSS = low school suspension group (i.e. 63 students with 0 or one suspension)

HSS = high school suspension group (i.e. 27 students with more than two suspensions)

* = $p < .05$, ** = $p < .025$, all two-tailed