

EVALUATING THE EFFECTIVENESS OF RISK EDUCATION FOR EARLY
ADOLESCENTS

By

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This work is dedicated to my father and mother, Jeremiah R. Haley and Patricia A. Haley

and

To the memory of my grandparents, Elder Lonnie M. Haley, Elizabeth C. Haley and Bishop C.D.

Kinsey

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ABSTRACT

This thesis is the result of an investigation of the effectiveness of incorporating risk education into the curriculum of early adolescents, notably students enrolled in fifth grade. As these students explore different aspects of environmental and human health risks that affect their everyday lives, it is important that they learn how to access objective information and utilize it in acting more responsibly. Studies have shown that people are unlikely to engage in healthy behaviors if they perceive the associated risk to be unsafe. Rather than have fear be the motivator of risk perception, if the appropriate education is provided to these students, knowledge will instead guide risk perception. This will allow the student to make more rational decisions involving risky behaviors.

The study began by reviewing existing risk-related curriculums, so as to identify those educational techniques that have proven to be successful, as well as to determine where educational material was lacking in its treatment of risk-related subject matter. A modified risk education curriculum was subsequently developed, building on the best practices observed in reviewing previous initiatives. This risk education module was subsequently offered to five fifth grade classes affiliated with two different public school systems in northern Alabama. The effectiveness of the risk education module was evaluated by administering a “risk” exam to the students. One-half of the students in each class was randomly chosen and given this exam prior to the introduction of the risk education module (control group). The remaining students were given the same exam after receiving the risk education module. Based on the exam results, it was found that the group receiving the risk education module scored at statistically significantly

higher levels than the control group, an improvement of more than 20%. Based on these results, it can be concluded that introducing risk education curriculum to early adolescents can be an effective means to providing students with an improved knowledge base and thought process upon which to exhibit more responsible risk behavior.

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CHAPTER I

INTRODUCTION

Risk can be defined in terms of the likelihood and consequences of an outcome, either positive or negative (Hansson, 2000). Although avoiding negative outcomes is human nature, it is not always possible because there is an inherent risk present in every aspect of our lives. Risk can be described both quantitatively and qualitatively. A quantitative analysis can be carried out using mathematical equations which involve the use of statistics and probabilities, such as a 1 in 10 chance of a serious accident. On the other hand, a qualitative analysis can be made by a subjective rating of the extent of damage that can be caused by a threat, such as the risk of an attack is high or excessive.

Kaplan and Garrick (1981) developed an excellent framework for risk assessment that they named the “Risk Triplet”:

What can go wrong (events)?

What is the likelihood (probability)?

What are the consequences?

where risk is defined as the product of probability times consequences.

Accurately portraying risks can be a complicated task particularly with the rapid advancement of technology and globalization. From genetically modified foods to toys containing lead, trying to manage the exposure to undesirable outcomes is becoming more difficult. Moreover, sometimes

by reducing one risk, a more serious one is created as a result of the focus being shifted in an improper manner. For these reasons, the need for risk education is fundamental, thereby enabling individuals to make responsible decisions.

Risk Perception

The concept of risk perception came about in the 1960's (Pange, 2003). Researchers noted the difference in how people perceive risk. For example, it is believed that individuals will inflate risk or discount risk depending on several factors including: knowledge of the activity, the degree to which the risk is believed to be controllable, and the extent to which incurring the risk is voluntary (Slovic, 2000).

Differences in risk perception can also be attributed to where a person grew up, experiences they may have had, and individual personalities. Psychologists have researched and theorized four different personalities which may affect how a person views risk (Pange, 2003):

- Individualists: “are enterprising ‘self-made’ people, relatively free from control by others and who strive to exert control over their environment and people in it.”
- Hierarchs: “inhabit a world with strong group boundaries and binding prescriptions, with everyone knowing his or her place”.
- Egalitarians: “have strong group loyalties but little respect for externally imposed rules. Group decisions are arrived at democratically and leaders rule by force of personality and persuasion.”

- Fatalists: have “minimal control over their own lives. They belong to no groups responsible for the decisions that rule their lives. They are resigned to their fate and they see no point in attempting to change it.”

These differences should be taken into account when considering implementation of a risk education program.

Although many considerations influence the way people view risk, there are a few factors which are known to affect a person’s perception of risk (National Research Council, 1998):

- Individual and social values
- Culture
- Experiences
- Level of education
- Outrage
- Who the person is and how he/she is affected
- Level of control over the event

As one of these factors, the level of education should be considered when attempting to influence risk. Moreover, education of early adolescents (Grades 5-8) is when such learning is in its formative stages.

Another argument for how a person perceives risk is based on humanistic psychology theory.

This theory “acknowledges that an individual's mind is strongly influenced by ongoing

determining forces in both their unconscious and in the world around them, specifically the society in which they live” (Depression Guide, retrieved 2009). This is based on Maslow’s Hierarchy of Needs (See Figure 1):

- Physiological
- Safety
- Psychological (Love/ Belonging)
- Esteem
- Self-actualization

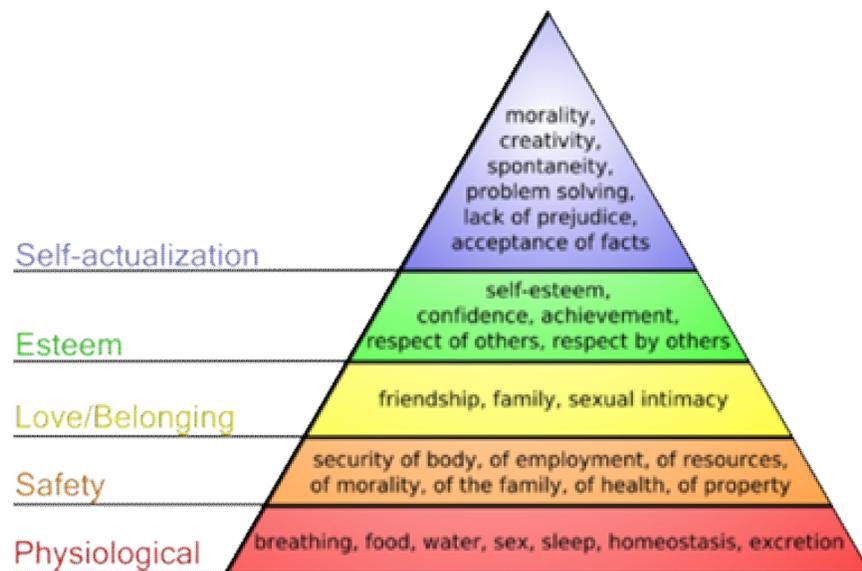


Figure 1: Maslow's Hierarchy of Needs (Jacob, 2007)

Adults as well as children are affected by the Maslow’s Hierarchy of Needs. The pyramid needs to be kept in mind when preparing risk and safety curriculums. If the curriculum is responsive to an individual’s needs, the student will be able to accept the education more readily.

Importance of Risk Education

Injury is the leading cause of death in children and young adults (Children, 2005). Because of this dismal reality, steps should be taken to overcome these, many times, avoidable accidents. According to statistics from the Centers for Disease Control and Prevention (CDC), there were approximately 2,800 children, ages one to 14, who died from an unintentional injury in the US from 2005 to 2007 (Children, 2007). Between the years of 2003 and 2005, over nine million children, ages one to 17, visited the hospital for an accident related injury. Of those, almost 800,000 children were treated for unintentional poisoning. Suffocation was the cause of nearly 100,000 children treated in the hospital between 2003 and 2005 (CDC, 2005).

In addition, drowning is the second leading cause of unintentional injury-related death among children ages one to 14 (CDC, 2005). Because lifeguards are not usually present, the majority of drownings occurs in residential swimming pools. These types of injuries can be avoided with education and by instilling the importance of evaluating risk and developing the ability of reasonably deciding when to take a risk. Approximately 45 percent of unintentional injury deaths occurred in and around the home (Children, 2005). Unintentional home injury and deaths to children are caused primarily by fire and burns, suffocation, drowning, firearms, falls, choking and poisoning.

From cyber bullying to road safety and alcohol abuse, students today face many different types of risks. For instance, road accidents are the leading cause of accidental injury among children and young people: every year, over 130 children die and more than 4,500 are seriously injured while walking and cycling (Department for Education and Skills, 2001).

The introduction of risk education in school-aged children could significantly reduce the number of child-related accidents. Due to the high occurrence and prevalence of these events, home, school, water, vehicle and health safety should be taught and stressed in a classroom setting. Students should learn how to evaluate and recognize risk in various situations.

Children and Risk Perception: Theory

Before attempting to address risk education in young children, we must first ask if they possess the ability to grasp the concepts presented. Researchers and psychologists have done considerable research on the cognitive development of a child. Piaget and Bruner have suggested stages of cognitive development (McWhirter, 1997). These stages are summarized in the Figure 2.

Age	Piaget	Bruner
Adult		
16	Can reason hypothetically	Symbolic representation
11	Formal Operational Stage begins - can reason on the basis of ideas, or verbal statements	(Iconic representation continues throughout concrete operational stage) Transition to symbolic representation begins
7	Concrete Operational Stage- can manipulate ideas when presented with real objects	Iconic representation begins - makes intuitive decisions about the nature of reality
2	Pre-operational Stage- simple reasoning, animism, intuitive, egocentric	Enactive representation based on learned behaviour
0	Sensorimotor Stage (Egocentric)	

Figure 2: A Spiral of Children's Cognitive Development (McWhirter, 1997)

Piaget also defined a four-stage development process: sensorimotor (birth to two years), pre-operational (two to seven years), concrete operational (seven to eleven), and formal operational (eleven to fifteen years). The message behind Piaget's work is that students should be taught only what their developmental stage allows.

Williams, Wetton and Moon, 1989 b; Hamilton, 1994	Coombes, 1991; Hamilton, 1994; Aucott, 1992	McWhirter and others, 1994, 1996
Adult		Risk is associated with everyday events, it may be long term and cumulative.
16	Emerging understanding of accident prevention	16 Risk may involve conflict with authority
Increasing practical skill		
11	Shows concern for the safety of others	11 Risk has a wider meaning but is largely short term
Acceptance of some personal responsibility	Can understand the consequences of serious accidents	Risk is commonly equated with extreme danger or minor criminal activity
Begins to generalise about safety issues	Believe the consequences of serious accidents are minor injuries	There is a simple relationship between cause and effect
Fewer imaginary fears expressed	Can understand or articulate the meaning of the word accident	Misbehaviour may be risky
Some understanding of personal responsibility		
Emerging awareness of simple cause and effect		
7	Knowledge of specific safety issues increasing	7
Objects may have intention to harm	Objects may have intention to harm	
Authority seen as a danger to avoid		Most have no understanding of risk. Some can relate personal risk to everyday events
Confusion about real and imaginary dangers - and about how to respond	Accidents may be caused by imaginary or fantasy characters	
4	No understanding of the word accident	

Figure 3: A Spiral of Children's Changing Perceptions of Keeping Safe of Accidents and of Risk (McWhirter, 1997)

Interesting facts such as at the age of 10 most children think that it is someone else's duty to keep them safe, stress the importance of a risk education curriculum implementation in grade school. At the age of 8 or 9, children begin to show concern for other's safety. Yet, many students believe that there are no long term consequences associated with an accident (McWhirter, 1997).

Based on these findings, it is clear that a curriculum should be developed which will teach students how to handle and recognize hazards such that they will generalize what they have learned to other situations.

In addition, from the aforementioned research, one can conclude that the students who will benefit most from the program are between the ages of 11 and 15. These students begin to exhibit characteristics of understanding and curiosity about risk-related ideas such as safety and accident prevention.

There are many researchers interested in the motivations surrounding an adolescent's thought processes. Consequently, several theories have emerged to explain adolescent behavior as well as certain risks he or she may take. They are presented below.

Cognitive-Developmental Theory of Risk Perception

There are various levels of thinking ability that adolescents experience. Concrete thinking, where one is able to sort, order, organize, and classify, is a phase where thought becomes logical and coherent. Abstract thinking entails the development of problem solving skills (Ylvisaker, 2008). As a child graduates from concrete to abstract, thinking becomes more self-focused. Adolescents believe that they are unique and are not susceptible to health risks and accidents. This is sometimes referred to as adolescent egocentrism (Greening, 2005).

Social-Cognitive Theory of Risk Perception

Our experiences, whether negative or positive, affect how we view risks and in turn those activities in which we choose to participate. When an adolescent experiences a negative result after participating in a certain activity, the likelihood of the child indulging in such activities again are significantly reduced (Greening, 2005). In contrast, children who had a positive experience while engaging in an activity are more likely to continue to engage in this activity in the future. Even if the negative consequence was isolated and highly improbable to re-occur, the child will still view that activity as risky.

Motivational Theory of Risk Perception

Pain, anxiety, and worry caused from stressful and sometimes nerve-wracking situations are never desirable. In order to reduce these feelings, a child may deem an unsafe situation as safe, instead of allowing him or herself to worry (Greening, 2005). The risk associated with the situation is minimized to avoid these stressful thoughts.

Cognitive Theory of Risk Perception

This involves the way people view themselves and the abilities they possess. Here, adolescents believe that they possess certain skills which allow them to avoid certain health risks and accidents. This optimism is unrealistic and is caused by faulty cognitive processes (Greening, 2005).

Greening and colleagues tested all of these theories, and found them to be appropriate in describing the different views of risk associated with adolescents. Their study also emphasized the importance of risk communication. When an informer realizes that other factors contribute to

how a person views a risk, he or she can make better decisions on how to communicate risk information.

Keeping these theoretical models in mind can make explaining risk education to children easier to understand and more effective. If we know how individuals perceive risk, risk education can be communicated without creating fear in the child.

CHAPTER II

REVIEW OF CURRENT RISK EDUCATION CURRICULUMS

In existence today are several programs which are devoted to drug, sex, and alcohol education. Among the more popular of these programs are D.A.R.E. (Drug Abuse Resistance Education), AlcoholEdu and Advocates for Youth. Collectively, they have proven successful in helping youths make more responsible decisions. However, while these programs teach students how to better handle specific risks, none focus on understanding risk as a fundamental concept or on how to apply risk knowledge to other situations where risk is encountered.

In order to address this gap, the following risk subjects would need to be covered at an appropriate level of detail (Department for Education and Skills, 2001):

1. Definition of hazards, risk, risk communication, and risk assessment
2. Recognition of hazards and risks
3. Assessment of the consequences associated with risky behavior
4. Managing their environment to ensure the health and safety of themselves and others
5. Understanding how to properly consider risk information received from the news.

Several curriculums have been developed with this goal in mind. Notable are programs offered by Project Learning Tree (PLT), the National Institute of Health, the Young Epidemiology Scholars Program (YES), and the Environmental and Occupational Health Sciences Institute

(EOHSI) Resource Center. To assess the extent to which each of these curriculums addresses the required risk subjects, an evaluation rating system was devised (see Table 1).

Score	Evaluation Criteria
0	The subject is not addressed in the curriculum.
1	The subject is briefly mentioned, but not analyzed thoroughly. There are no learning activities proposed to aid students in reaching a clearer understanding of risk.
2	The subject is covered in depth, including definitions and learning activities. However, the curriculum focuses on general information that is not age-specific.
3	The subject is covered in depth, including definitions and learning activities that are age-specific.

Table 1: Curriculum Rating System

In applying this technique, it was observed that while all of these programs appear to adequately cover the first four subjects, they are lacking in subject category 5, namely understanding how to properly consider risk information received from the news. This has the potential to be a glaring omission in a risk curriculum when one considers how much people of all ages are influenced by the manner in which the media covers an event. Moreover, media tend to focus on a disproportionate number of events in which there have been catastrophic outcomes, altering perceptions to an even greater extent.

CHAPTER III

DEVELOPMENT OF AN ENHANCED RISK EDUCATION MODULE

On the basis of this evaluation, it was concluded that there is room for improvement in the delivery of risk education to early adolescents. Rather than “reinventing the wheel” however, a more pragmatic approach, and the one described herein, is to utilize desirable subject matter in existing risk curriculums as a foundation upon which to build additional content. The resulting enhanced risk education module, geared towards early adolescents, is described below. Note that this module makes extensive use of the internet, class discussion, and hands-on activities as learning tools.

The enhanced risk education module consists of two lessons:

1. Is it always as bad as it seems?
2. Will the numbers deceive me?

Each lesson is described in the following discussion.

Lesson 1: Is it always as bad as it seems?

Although news is important, because it keeps us aware of current events and issues, watching the news can be frightening. Therefore, one must be able to discern fact from fiction when reacting to media coverage. To do this, one needs to understand that stories can be exaggerated, either by misrepresenting or withholding information. Therefore, a student must learn how to think about what they hear before responding in an irrational manner. Yet this lesson must be absorbed

without losing sight of the notion that sometimes action is prompted when it is indeed needed. Therefore, it is important to recognize both when it is appropriate to react and when it makes sense to take precautions while still remaining calm. This lesson is designed to help students manage this dilemma so as to lead to more responsible risk behavior.

The lesson begins with students being asked to search a list of internet sites and to select an article which may cause them to fear or worry about either a health crisis, natural hazard event, man-made terrorist attack, or some other dreadful situation. A short class discussion (20-30 minutes) is then held based on the events that are selected. This discussion should be guided by the following questions:

- 1.) What is the purpose of the article?
- 2.) What feelings are aroused when you read the article?
- 3.) Does the article make you want to learn more about the topic?
- 4.) Does the article present any numbers that can be verified?
- 5.) What can you do to prevent the event from affecting you (if applicable)?
- 6.) Will this prevention technique create other risks that were not present before?
- 7.) What is the worst outcome that could happen if the event occurs?
- 8.) Do you feel like this article presented you with knowledge that you can apply sensibly to protect yourself without causing greater harm?
- 9.) What motives might the news media have for presenting the story?
- 10) What attracted you to the article?

By utilizing this approach, “risk in the news” is introduced in a manner that eases the student into thinking about managing risk as part of a daily routine.

Lesson 2: Will the numbers deceive me?

Often, a news story will quote statistics that are deceptive or misleading to the audience. This lesson focuses on recognizing that one should not take these numbers at face value, but rather it requires a deeper examination as to whether the statistics were properly derived and are appropriate for the context in which they are being used. This lesson makes extensive use of a PowerPoint presentation produced by BBC Magazine, *How to understand risk in 13 clicks*.

The lesson begins by having each student use a computer to visit the following url:

http://news.bbc.co.uk/2/hi/uk_news/magazine/7937382.stm. This website provides a short explanation of how numbers can mislead an audience by making claims seem large when in reality they are not. Figure 4 displays the first of this 14-slide presentation.

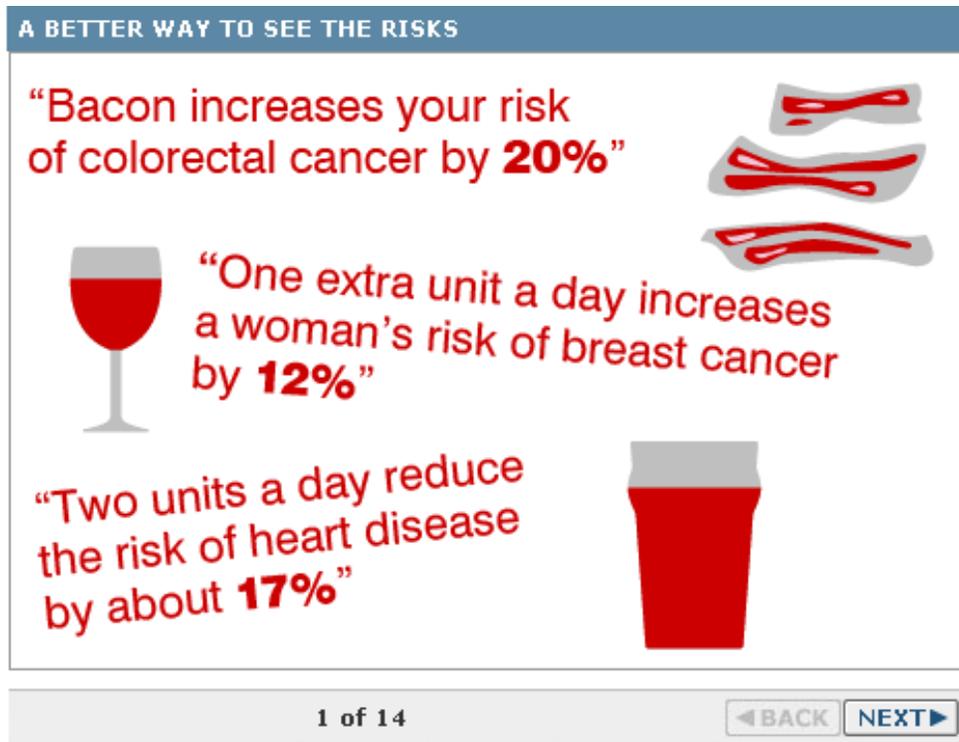


Figure 4: Screen Shot of Presentation on Statistics and the News (BBC, 2009)

After reviewing the entire presentation, students are asked to share their opinions and feelings. This is followed by a facilitated discussion of how statistics can sometimes be misleading.

In the next part of the lesson, students are asked to rank some of common risks they encounter on a regular basis. The ranking results of risk experts considering the same risks are then provided, and the expert and student results are compared. After completing this exercise, the educator discusses why students ranked certain activities higher than others, eliciting factors that affect risk perception. Concepts such as risk communication and risk assessments are subsequently presented.

Finally, a discussion is held on how to assess everyday risks as well as how to limit the consequences should an undesirable event take place. Students are asked to recall past situations where they foresaw a potentially negative situation. They are then asked what steps could have been taken to reduce the impact of the associated consequences. Brainstorming is encouraged, leading towards having the students reach a consensus on the most plausible solution.

CHAPTER IV

EVALUATING RISK EDUCATION EFFECTIVENESS

The method selected to evaluate the effectiveness of the proposed risk education module was to create an experimental design by dividing a fifth grade class into a pre-test (control) group of students and a post-test group of students. Students were randomly divided into each of these groups. The exam was administered to the control group before the risk education module was presented. This group provided a reference point from which to compare the test results of the group of students who were administered the same exam after participating in the risk education lessons.

The exam focused on evaluating the curriculum's effectiveness in addressing each of the aforementioned risk subjects. To determine if the curriculum was successful in accomplishing this goal, at least one question on the exam was structured to test the student's knowledge or perspective on each risk subject. More than one question was offered in certain subject areas to create an element of redundancy.

The exam consists of ten, multiple-choice questions. For each question, the student must select from among three possible responses. The choices correspond to whether a student recognizes a risk and takes necessary steps to mitigate it or ask for help, overreacts to the risk in an unhealthy manner, or does not react or under-reacts to the risk believing that they are invincible and cannot be affected by the situation. A score of 15 is given to an answer where the student recognizes the

risk and attempts to mitigate it in a responsible manner. A score of 10 is assigned to an answer where the student recognizes the risk, but attempts to rectify it by overreacting. Finally, a score of 5 is given to an answer where the student does not recognize an unsafe situation or who recognizes the situation, but believes they will remain unaffected. The maximum total score that a student can achieve is a score of 150.

A list of the exam questions appears below; the italicized words explain the meaning of each potential response and did not appear to the student on the exam form that they received.

1. **Steps to Mitigate Risk:** You see an electrical cord in the reach of your three year old sister. She is still going through her discovery age and heads towards the dangling cord. You.....
 - a.) Yell at her not to touch the cord
Recognize the situation but student is not sure how to handle the situation in order to mitigate risk
 - b.) Go over and take the cord from her and move it out of her reach
Recognize the risky situation and decides on the best way to handle the situation to avoid harm to the young child
 - c.) Ignore her as you were just heading to the living room to watch your favorite television show
Does not recognize harmful situation or recognizes the situation but chooses not to act on it believing that nothing bad could happen

2. **Risk in the News:** You are finishing up your homework in the living room where your mom is watching the news. Channel 101 is talking about the accidental contamination of soap which has caused 10 deaths in the last 3 days. You look at your mom and she looks worried, but does not say anything. You.....
 - a.) Finish your homework and you don't ask her any questions
Student dismisses the news; takes no initiative to find more information, assumes an attitude of "it won't affect me"
 - b.) You go back to your room and do some research online concerning the soap contamination crisis, then talk about it with your mom
Student recognizes the risk but before reacting; finds out more information from reputable sources
 - c.) You go through the house throwing all dish detergent, bath soap, face soap, and laundry detergent away
Student overreacts with minimal information

3. **Managing your environment to ensure the safety of yourself and others:** You are throwing a birthday party for your five-year-old cousin and his friends. He invites 17 kids to the party. You have a large backyard without a fence and on occasion you see random wild dogs walk across your backyard. You.....
- a.) Ignore the dogs because you rarely see them
Student dismisses the problem, taking the easy way out of the situation and putting others at risk
 - b.) Allow them to have the party in the backyard, but keep a watchful eye out for any signs of wild dogs
Student realizes that the safety of others may be at jeopardy, but instead of managing the situation, the student merely chooses to take the path of least resistance
 - c.) Move the party indoors although your cousin will be unhappy and the kids will not have as much room to move around
Student recognizes the unsafe situation and chooses to mitigate the situation even though it may not be a popular choice
4. **Risk in the News/Managing Your Environment:** Your best friend gets on the bus raving about how his family and at least 7 of his close friends had a strange adverse reaction to a toothpaste that your family uses frequently and recently bought in bulk. You.....
- a.) Without telling your parents, you throw all of the toothpaste in the dumpster because you love your family and want to keep them safe. Plus your mom may not want to get rid of it all.
Student reacts irrationally without first obtaining the facts; relies on information obtained from a friend
 - b.) You tell your parents what your friend said to you, they may listen to you and agree to throw the toothpaste away
Student realizes that he or she may not have all of the knowledge necessary to manage his or her environment. So, student chooses to gain more information by discussing with parents.
 - c.) You ignore it because your friend is always joking and telling lies and you don't want to worry your parents over nonsense
Student recognizes the potential risk but dismisses the information because of the source
5. **Understanding Probabilities and Statistics:** You read a statistic which states that 50% of all kids crash while riding their bike. You.....
- a.) Continue riding your bike. You have been safely riding since you were four.
Student recognizes the risk and acknowledges the fact that he or she already is taking necessary precautions to avoid crashes
 - b.) You stop riding your bike and walk everywhere...it's a lot safer
Recognizes the risk, but reacts passionately and irrationally
 - c.) You don't believe the stat because you know plenty of kids who ride bikes and they are fine

Student does not take time to research the information or acknowledge the actual risk of riding a bicycle. Attitude represents “It won’t happen to me”

6. **Defining Risk Assessment:** A risk assessment is a.....
- a.) Method of taking a risk
Student has a cloudy definition of the purpose of a risk assessment
 - b.) Method of assessing the potential of a dangerous event in order to gain information used to make a decision
Student provides a clear understanding of the definition of risk assessment
 - c.) Method of expressing risk to a group of people
Student does not have an understanding of risk assessment
7. **Defining Risk Communication:** Risk communication and risk perception are affected by all of the following factors except
- a.) Familiarity
Student does not have an understanding of the factors which affect risk communication and risk perception
 - b.) Result from man-made sources
Student has an understanding of the factors which affect risk communication and risk perception but does not grasp the concept fully.
 - c.) Computer Related
Student realizes that this factor is completely unrelated

This section of the exam elicits the student’s views on relevant environmental issues

8. **Nuclear Power:** Your thoughts about nuclear power consist of....
- a.) What EXACTLY is nuclear power? I have no idea....
Student has no knowledge of nuclear power, so student would be more susceptible to believe poorly researched information
 - b.) Nuclear power should be implemented in some areas even with its admitted problems, but it should continually be researched
Student has knowledge of nuclear power and recognizes its positives and negatives.
 - c.) Nuclear power is more harmful than helpful and has no merit for any form of use.
Student shows unsubstantiated fear towards nuclear power
9. **Genetically Modified Foods:** When you see a package marked as a GMO in a grocery store you...
- a.) Put the package immediately back on the shelf, thinking it is unhealthy and dangerous
Student shows a strong fear of GMO without understanding both sides of the issue
 - b.) Have no idea what a genetically modified food is, but you purchase it anyway
Student lacks basic understanding of a genetically modified food and the positives and negatives surrounding the issue
 - c.) Ask your mom about it

Although the student is not sure about the facts surrounding the issue, he or she finds information from a more reliable source

10. Cancer: When thinking about cancer you believe....

- a.) Everyone is at a HIGH risk of getting cancer
Student views cancer as a high risk without considering the facts surrounding the disease
 - b.) Although I am at risk of cancer, it is a small risk and will probably never happen to me or anyone I know
Student has a "it can't happen to me" attitude without considering the facts
 - c.) Smoking, drinking and bad eating habits have a huge effect on my risk of cancer.
Student recognizes the behaviors that increase the risk of developing cancer.
-

CHAPTER V

EVALUATION RESULTS

The exam was administered to five elementary school classes associated with two different public school systems in northern Alabama. One-half of the students were randomly chosen and given the exam with no preparation (control group), while the other one-half of the classroom students took the exam after receiving the risk education module. Results are reported to three (3) significant figures. Raw data are shown in Table 2.

Table 3 presents the pre- and post-curriculum test results for each individual student, organized by class and school system. The percent change in the mean score for each class is shown in Figure 5. An overall increase in the means corresponding to the control and experimental group was found to be 23%, corresponding to an increase in the Madison schools of 26% and an increase in the Huntsville schools of 20%.

Several hypothesis tests (t-tests) were performed to determine whether the change in test scores was statistically significant. The results are presented in Table 2. As shown, for every classroom, the null hypothesis, $H_0: \mu_1 = \mu_2$, was rejected at the 95% confidence level. This leads to a conclusion that there is a significant improvement in the quality of student response to risky behavior scenarios by having been administered the risk education module.

While these initial hypothesis tests focused on the overall effectiveness of the risk education module, a second set of hypothesis tests were performed to determine any significant difference in student responses to specific risk subjects. The mean improvement for each question appears in Table 5, while the results of the corresponding t-tests are shown as part of Table 4. As noted, there is a statistically significant improvement for each exam question at the 95% confidence level. On this basis, one can surmise that the risk education module was effective in improving knowledge across every subject area.

Table 2: Individual Test Scores

<i>Madison City School System</i>						<i>Huntsville City Schools</i>			
Experiment 1		Experiment 2		Experiment 3		Experiment 4		Experiment 5	
Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
85	130	125	130	100	145	130	135	130	135
85	145	125	130	125	125	130	130	130	150
110	120	95	135	125	130	130	150	100	145
115	130	125	140	95	125	120	140	125	135
85	125	135	125	110	140	110	140	130	150
85	130	100	140	95	145	120	140	130	145
115	145	120	150	125	140	105	140	120	150
110	140	110	140	135	135	90	150	120	150
115	125	110	150	105	125	100			
105	145	95	140	90	150				
85	135	115	130	95	140				
105	135		120						
105	140								

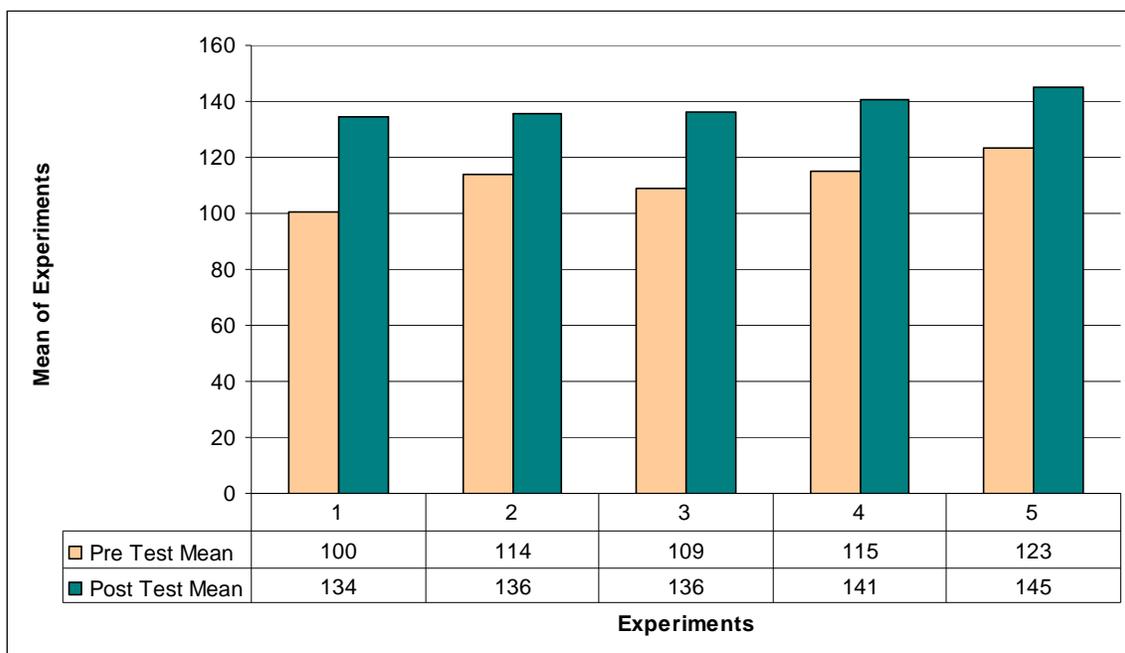


Figure 5: Pre and Post Test Means for Each Classroom

Table 3: Data Used to Complete t-Test

Experiment	t₀	t-stat
1	-7.83	1.73
2	-4.49	1.73
3	-4.98	1.75
4	-4.73	1.78
5	-5.06	1.78
Questions		
1	-3.61	1.68
2	-5.60	1.68
3	-3.50	1.68
4	-3.93	1.68
5	-4.32	1.68
6	-2.58	1.68
7	-4.28	1.68
8	-4.54	1.68
9	-4.53	1.68
10	-10.90	1.68

Table 4: Percent Increase in Mean for Each Question

Questions	1. Steps to Mitigate Risk	2. Risk in the News	3. Managing your environment	4. Risk in the News/Managing Your Environment	5. Probabilities and Statistics	6. Defining Risk Assessment	7. Defining Risk Communication	8. Nuclear Power	9. Genetically Modified Foods	10. Cancer
% Increase in Mean	13.4%	32.7%	16.4%	19.5%	19.4%	15.5%	41.4%	41.1%	25.4%	25.2%

CHAPTER VI

CONCLUSION

Based on prior work directed at offering formal risk education to early adolescents, an improved risk education module was developed and tested in several fifth grade classrooms. The results of this effort are extremely encouraging in terms of a student's ability to seek credible information upon which to form risk perceptions, as well as in assimilating this information to motivate more responsible risk behavior.

These outcomes are important when placed in the context that early adolescents are in the formative learning stages of risk and safety. It is a time when they care about and form perceptions of how they should protect themselves and others. While these study results are limited to a specific risk education module, applied to a limited sample in one geographical area of the country, it offers promising results that early adolescent educators should take quite seriously. It is hoped that this effort can help spawn greater interest in offering formal risk education to early adolescents, as well as in expanding the types of risk-based curriculums that can be offered to students in this age group.

REFERENCES

- BBC News Magazine “How to understand risk in 13 clicks” 2009. <http://news.bbc.co.uk/2/hi/uk_news/magazine/7937382.stm>
- CDC Health Data Interactive “Injury visits to emergency departments by intent and mechanism” (2005). Retrieved April 18, 2009, from <<http://205.207.175.93/HDI/TableViewer/tableView.aspx?ReportId=55>>
- Children’s Hospital of the King’s Daughter. “Common Childhood Injuries and Poisoning: Accident Statistics.” (2007) Retrieved April 18, 2009, from <<http://www.chkd.org/healthlibrary/Content.aspx?pageid=P02853>>
- Department for Education and Skills. “Safety Education: Guidance for Schools.” Reference: DfES/0161/20002 December 2001
- Depression Guide.” Theory in Humanistic Psychology.” Retrieved May 1, 2009, from <<http://www.depression-guide.com/humanistic-psychology-therapy.htm>>
- Greening, L., L. Stoppelbein, and C.C. Chandler. (2005) Predictors of Children’s and Adolescents’ Risk. *Journal of Pediatric Psychology* Advance Access. Pages 1-11
- Hansson, S.O. Seven Myths of Risk. (2000). Conference: Stockholm thirty years on. Progress achieved and challenges ahead in international environmental co-operation.
- Jacob, W. “Abraham Maslow and the Gospel of Thomas” (2007). Retrieved May 1, 2009, Image from <http://kenosisdown2earth.files.wordpress.com/2008/01/maslows_hierarchy_of_needs.png>
- Kaplan S.and B. J. Garrick, “On the Quantitative Definition of Risk”, *Risk Analysis* v, 1 (1), 1981.
- McWhirter, J. The Royal Society for the Prevention of Accidents. “ Spiraling into control?” (1997)
- National Research Council. *Improving Risk Communication.* Washington, D.C.: National Academy Press; 1989.
- Pange, J. and M. Talbot. Literature “Literature Survey and Children’s Perception on Risk” *ZDM* 2003 Vol. 35(4)
- Project Learning Tree. 2004. 4 July 2009. <<http://www.plt.org/>>.

Resource Center EOHSI. Environmental and Occupational Health Sciences Institute. 2006. 3
June 2009. <<http://www.eohsi.rutgers.edu/rc/curricular.html>>.

Slovik, P. The Perception of Risk, Earthscan Publications Inc.,2000.

Ylvisaker, M. “What are Concrete and Abstract Thinking?” (2008). Retrieved April 16, 2009.
From <http://bianys.org/learnnet/tutorials/concrete_vs_abstract_thinking.html>