

CHALLENGE COURSE SAFETY: A STUDY OF
MANAGEABLE FACTORS CONTRIBUTING TO
INCIDENTS ON HIGH ELEMENTS

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CHAPTER I

INTRODUCTION

“The growth of adventure leisure endeavors, such as challenge courses, that contain elements of danger has resulted in an increased concern for the safety of the participants” (Confer, Wilson, Kim, & Constintine, 2003, p.3). The high elements of a challenge course are often of particular concern to insurance companies, as they pose the most obvious potential for serious injury or death. This research seeks to explore incidents on the Oklahoma State University Challenge Course via close call and near miss documentation in an effort to assess overall risk in a challenge course environment.

The challenge course combines ropes, cables, and platforms in either a free standing structure or in combination with the natural terrain and inherent features (rock faces, trees, rivers, etc) to create an environment filled with physical and mental challenges designed to engage the individual and group in common experiences designed to increase skills in areas such as: communication, and problem-solving (Rohnke, Tait, & Wall, 1994). Challenge courses have been around since the early 1960s in the United States. Many serve as an integral part of adventure based programs – such as Outward Bound (Hattie, Marsh, Neill, & Richards, 1997).

The field of adventure programming has undergone many dramatic and rapid changes over the past 50 years. According to Gass (1998) some indicators of growth include:

- The exponential increase in programs using adventure programming
- New and rapidly evolving applications of adventure programming to specific populations
- Greater increase and acceptance of adventure programming as a medium for producing functional change for different populations
- Increase in the number of professional organizations associated with adventure programming
- Increase in the artificially constructed adventure environments for programming (e.g., artificial climbing walls, challenge courses)
- Increase in the level of research and program evaluation demonstrating the effectiveness of adventure programming with a variety of applications

In addition to the factors noted above, Project Adventure /Alpine Towers Safety studies demonstrate that challenge course structures and participant hours have been steadily increasing since 1981. The 20-year Safety Study from Project Adventure (PA) provides a twenty-year snap-shot of the growth in new courses or programs offering challenge course programming. The reported participation numbers for PA surveyed courses grew from 15,190,864 user hours in 1981 to a combined 57,609,824 user hours by 1991.

Alpine Towers International (ATI) is another organization that has shown an increase in the number of courses in last decade. Since ATI's initial construction of an

Alpine Tower in July 1989, data were collected to facilitate compilation of a 10-year Safety Review from 127 surveys sent to ATI programs (Alpine Towers, 1999). Since 1999, Alpine Towers has continued to build new courses with a total 230 Alpine Towers as of 2005 (Sickler, 2005). “When the survey returns were closed in July, 1999, 60 organizations recorded 55,336 people having participated in 1,320,334.25 hours of Alpine Tower program facilitation” (Alpine Towers, 1999, p.5). The increase in new course construction and reported participant hours clearly demonstrates continued interest and growth in the challenge course industry.

In general, participant safety is a primary concern for adventure programs. The rapid rise in the number of challenge courses being used "in mainstream areas such as education, corporate training, mental health services and the criminal justice system" warrants particular attention to the safety needs associated with the challenge course environment (ACCT, 1998 p.2). Technology and facilitation each focus on producing an increasingly safer environment in which participants are challenged to grow. Technology has provided advances in equipment while review teams work on improving facilitation techniques and promoting standards in a new industry.

Project Adventure’s 20-year safety study points out that when compared to other adventure activities, such as backpacking, competitive orienteering, and sail-boarding, challenge courses yield an extremely low rate of accidents. By the same token, the industry still sees rising accident rates. PA’s study shows a rise from 78 accidents/injuries on challenge courses in 1981 to 93 accidents/injuries in 1991. Comparing the injury rate (as calculated by PA), we see that in ten years, the injury rate rose from 5.13 per million in 1981 to 6.22 in 1991. The Alpine Towers 10-year Safety Study a total of 179 incidents

on ATI challenge courses reported between the years 1989-1999. The study demonstrated that serious accidents had the lowest rate of occurrence at 1 per 3074 participants, while minor accidents had an occurrence rate of 1 per every 709 participants.

In addition to documenting accidents and injuries, some courses document what are known as “close calls” or “near misses”. A “near miss” situation occurs when there are no injuries or property damaged, but there is evident potential for injury (Hale, 1990; Liddle & Storck, 1995). The documentation of “close calls” or “near misses” provide a powerful tool for researchers to gain insight into the safety of challenge course participants as a means of becoming more proactive in preventing accidents. The definition of accident suggests there is a connection between near misses and injuries (Liddle & Storck, 1995).

As pointed out by the Alpine Towers 10-year safety study, close call/near miss events are often unusual situations that should be seriously reviewed in order to prevent similarly dangerous situations in the future. A primary advantage of analyzing near miss situations is that instructors learn that reporting these situations helps everyone understand the dynamics of accidents and increases the chance of avoiding future injury (Liddle & Storck, 1995). In addition to studying near miss situations, discovery of interacting factors in the near miss situation may reveal further relevant information (Liddle & Storck, 1995).

Keeping track of near misses and caring for a problem or hazard before it becomes an injury provides organizations an excellent means to reduce accident potential (Hale, 1990). Additionally, these incidents offer facilitators, participants, and providers a valuable lesson in protection, serving as excellent training device for instructors (Alpine

Towers, 1999; Liddle & Storck, 1995). The Alpine Towers Safety Study (1999) reported a near miss incident rate of 1 for every 667 participants, noting that near miss reports are as important as accident reports, in that the information provides a glimpse into the future and offers the opportunity to develop a safer program (Alpine Towers, 1999). Since the practice of maintaining near miss information is not an industry requirement and is most often found in large organizations that operate challenge courses, little research has been done in the area of close calls and near misses. Studying potential accidents from this perspective provides the industry as a whole with insight for future development and design innovations for safer structures without compromising the essence of the experience (Alpine Towers, 1999).

Purpose

The purpose of this study is to provide an accurate assessment of the relationship between challenge course incidents and: 1) type of element; 2) transfer station; 3) type of belay system; 4) type of incident; 5) participant gender; and 6) age. This information will provide new insight into relationships between these factors, contributing to better risk management policies and procedures for challenge courses. The ultimate goal is to identify manageable factors that contribute to or increase participant exposure to actual risk. The data set for this study are close call/ near miss forms from a college challenge course between the years of 1994 and 1997.

Need for the Study

The presence of industry resources such as Project Adventure, Association for Challenge Course Technology, Association of Experiential Education, and Outward Bound provide statistical data on recorded injuries for challenge courses. The information

provided in these reports is broken down into individual elements or activities. Since much of the information in the past has "been collected by programs' voluntary participation, we cannot be certain programs with poorer safety records or less careful record keeping have been equally represented" (Furlong, Jillings, LaRhette, & Ryan, 1995, p.4). The information reported is voluntary in varied formats with ranging degrees of accuracy, numerous holes remain unfilled. Two such "holes" constitute the focus of this study.

First, there is no mention of the relationships between reported incidents and elements, transfers, belay type, incident type, gender, or age. These factors represent a small but significant collection of controllable factors that may aid in more effective management of risk in challenge course settings. Second, the reports make no significant mention of incidents of "unclipping" on high elements. In order to traverse through a series of high elements, participants must successfully transfer from one element to the next. A transfer consists of: 1) movement to a subsequent element; 2) attaching one's self to the corresponding belay using a carabiner; and, 3) detaching one's self from the previous element's belay and carabiner. Inherent to this process is the potential for a participant to be detached from a belay - "unclipped". A study of the factors that influence a participant's exposure to risk is seemingly essential if we are "to provide standards that better define safe construction and facilitation" of challenge courses (ACCT, 1998, p.2).

Research Question and Hypotheses

The research question this study is to examine: What are the controllable factors that impact the number of incidents on a challenge course? As such, it examines the following hypotheses:

- HO₁ There are no differences in the number of incidents from one high element and another high element.
- HO₂ There are no differences in the number of incidents from one transfer station and another.
- HO₃ There are no differences in the frequency of incidents between static and dynamic belays.
- HO₄ There are no differences in the type of incidents.
- HO₅ There are no differences in the number of incidents between females and males.
- HO₆ There are no differences in the number of incidents from participants under the age of 16 and participants over the age of 16.

Glossary of Terms

Accident: an unplanned, potentially dangerous occurrence that results in injury, property damage, or a close call (near miss), (Caution: never equate the word accident with injury) (Leemon, Schimelpfenig, Gray, Tarter, & Williamson, 1998, p.3)

Accident Potential: An intangible variable produced by the interaction of human and environmental hazards. Also, a conceptualization of the result of people interacting with environments that indicates increasing or decreasing danger or risk of injury (Leemon et al., 1998, p.3)

Actual Risk: a.k.a. objective risk – aspects of nature that are beyond the control of the instructor (Hunt, 1990, p.34)

Adventure Education: one form of experiential education characterized by: (a) the planned use of adventuresome activities; (b) a real-life activity or learning context; (c) goal-directed challenges that must be solved individually and in groups; (d) an outdoor or wilderness setting; (e) cooperative small group living and activity participation; (f) trained leaders/facilitators; and, (g) specific, pre-planned educational or developmental goals (Bladwin, Persing, & Magnuson, 2004, p.168)

Anchor Point: A fixed point to attach a belayer or belay device (Rohnke et al., 1994, p.19)

Belayer: person at the end of the rope who protects, catches, or lowers a climber (Rohnke et al., 1994, p.19)

Belaying: a technique which protects a climber by use of ropes, carabiner, cable and belay devices; a rope is attached to the climber, which then runs between the safety cable and the belayer; the belayer will hold the rope in such a way that s/he is able to catch and keep the climber safe if s/he should fall (Rohnke et al., 1994, p.18)

Brake Hand: the hand that grips the end of the rope after it passes through a belay device or around the body. This is generally the individual's dominant hand; the brake hand remains on the rope as long as the climber is on belay (Rohnke et al., 1994)

Burma Bridge: challenge course element resembling a fancy Two Line Bridge (see definition below) in which a third cable is strung horizontally overhead as a belay cable (Rohnke et al., 1994, p.127)

Cat Walk: (aka) Balance Beam; challenge course element consisting of a log or utility pole supported horizontally between two tress or poles (Rohnke et al., 1994, p.123)

Carabiner: spring activated, metal link use to connect climbing rope to a harness system (Rohnke et al., 1994, p.30)

Carabiner Locking: carabiner with a screw locking gate or collar (Rohnke et al., 1994, p.30)

Carabiner Auto Locking: a locking carabiner [with] a spring that automatically positions the sleeve whenever the gate is closed (Graydon & Hanson, 1997, p.128)

Cargo Net Climb: challenge course element consisting of a cargo net which hangs vertically providing a series of rope rungs to access additional high elements; a cable is suspended horizontally overhead as a belay cable

Chaplin Shuffle: aka Kitten Crawl; challenge course element consisting of parallel foot cables provide the bridge between two platforms; a cable is suspended horizontally overhead as a belay cable

Dynamic: a rope or system capable of stretching, giving or elongating when stopping a fall or force applied to the system; in a Ropes Course context, it refers to either a type of Ropes Course, a type of belay, or the rope itself

Dynamic Belay: utilizes a belayer who controls the safety rope to the participant; the belayer is stationed on the ground and is able to protect, catch, or lower the participant in a safe and controlled manner; see *Static Belay* for comparison (Rohnke et al., 1994, p.18)

Dynamic Rope: rope that stretches, used in belaying situations (Graydon & Hanson, 1997; Rohnke et al., 1994)

Dynamic Ropes Course: involves largely separate elements from which a participant is dynamically belayed (Rohnke et al., 1994)

Experiential Learning: a philosophical orientation toward teaching and learning which values and encourages linkages between concrete, educational activities and abstract lessons to maximize learning (Luckner & Nadler, 1997, p.3)

Failure to Complete: when a stops or refuses to progress through the course and chooses to be lowered by an instructor from the high elements prior to completing the course via the Zip line

Fixed Belay: belay point that is stationary and does not move from point to point (Rohnke et al., 1994, p.19)

Grapevine: aka Multi-vine; challenge course element consisting of a taut horizontal foot cable is traversed by using only the sequentially hung vine-like ropes which require a lunging motion to reach from one rope to the next i.e. requiring the participant to be briefly free of both ropes; a third cable is strung horizontally overhead as a belay cable (Rohnke et al., 1994, p.124)

Guide Hand: on the side of the rope going to the climber, this hand aids in taking and letting out the rope; at other times, it is used for rope tension; the guide hand does not assist in the braking process (Rohnke et al., 1994, p.19)

Figure Eight Follow-Through: the figure-eight knot variation that is used extensively by climbers; tying-in using this knot sequence precludes the use of a carabiner, which gets rid of an unnecessary link in the belay chain (Rohnke et al., 1994, p.69)

Harness: either commercially made or tied by the student using nine millimeter rope or one inch tubular webbing, which provides a safe secure connection point for the climbers belay rope, and the belayers carabiner and belay device (Rohnke et al., 1994)

Hazard: the conditions that accentuate or influence the chance of an injury or loss occurring (Priest, 2000, p.46)

Heebie Jeebie: aka Hourglass Bridge; challenge course element consisting of a taut horizontal foot cable is traversed via the fabricated hand lines created by descending and ascending ropes [two diagonally crossing multivine ropes, forming a quasi-hourglass shape] attached to the foot cable and opposing vertical supports; a third cable is strung horizontally overhead as a belay cable(Rohnke et al., 1994, p.125)

Incident Report: narrative report of a potentially dangerous situation where safety was compromised but did not result in an injury (Leemon et al., 1998)

Incline Log: challenge course element consisting of a log or pole attached between two vertical poles diagonally ascending to a platform or balance beam as access point to additional elements; a cable is strung horizontally overhead as a belay cable (Rohnke et al., 1994)

Inherent Risk: risk involved in an activity that is a normal, integral part of the sport; not including potential danger caused by negligence, which may include poor instruction, defective equipment, lack of safety devices, facility layout or construction, poor officiating, and dangerous environmental conditions (Van der Smissen, 1990, p.93)

Kernmantle: a core-covered rope; the core (parallel twisted nylon fibers) is the kern; the mantle is the woven covering (Rohnke et al., 1994, p.25)

Leap of Faith: challenge course element consisting of two platforms with a gap in between two to four feet; a third cable is strung horizontally overhead as a belay cable

Near Miss/Close Call: is a potentially dangerous situation where safety was compromised but that did not result in reportable injury; an unplanned and/or unforeseen event, ruling out situations such as routine top rope falls, failure to roll a kayak for a beginning student, or a fall on a trail with no injury; a situation where those involved express relief when the incident ends without harm (Leemon et al., 1998, p.17)

Objective Hazards: are usually quantifiable; they represent the overall condition of the environment e.g. weather, wild animals, rock fall, avalanche and moving water (Leemon et al., 1998, p.5)

Perceived Risk: the perception of risk or dangerous situation to untrained observer or participant in which the actual dangers are minimized or managed by various safety systems (Hunt, 1990)

Risk Management: the management of risk factors surrounding an activity to reduce the accident potential (Liddle & Storck, 1995, p.3)

Risk-taker: noun: a person or corporation inclined to take risks (Webster's, 1996, p.1660)

Participant (or program) Hours: A measure of program size; the product of multiplying the number of hours a program is responsible for participants by the number of participants (Leemon et al., 1998, p.3)

Peril: the sources of injury or the cause of a loss (rock fall) and can usually be avoided (Priest, 2000, p.46)

Rat Tail: slang term for fixed length static belay line (approximately 3' – 6' long)

Static Belay or Self Belay: is a system that connects a participant to an overhead belay cable by use of a carabiner and a three to six foot piece of rope or webbing attached to the climber's harness. This system is put into use after a participant has been dynamically belayed to a high element (Rohnke et al., 1994, p.18)

Static Rope: rope with minimal elasticity, and it is utilized for loads in which elongation is not desired such as, rescue situations (Graydon & Hanson, 1997)

Static Ropes Course: a series of connected elements, which a participant traverses from element to element by use of a static belay system (Rohnke et al., 1994, p.19)

Subjective Hazard: expressions of our humanness: our personality; our attitudes; and states of mind (Leemon et al., 1998, p.5)

Transfer Point: end of one element, beginning of another containing an anchor point to which a static tether is clipped to facilitate transferring between elements

Two Line Bridge: aka Postman's Walk; challenge course element consisting of cables that involves maintaining foot contact with the bottom cable and hand contact on the chest high cable; a third cable is strung horizontally overhead as a belay cable (Rohnke et al., 1994, p.126)

Unclipping or Improper Clip-ins: unclipping the belay from a harness while on-belay or failure to clip the belay rope carabiner to the belay loop of the harness

Unsafe Acts: common unsafe acts on courses are slips/falls in non-climbing situations and overuse/physically strenuous actions, including stove fires, rolling or falling rock, slips on snow and failure to follow instructions (Leemon et al., 1998, p.5)

Walking Belay: a belay system that moves with the climber from point A to point B (Rohnke et al., 1994, p.19)

Zip Line: challenge course element used as a means of descending from a high ropes course event by rolling down an inclined cable on a two-wheel pulley; the rider is connected between a seat harness and the pulley by a section of double eye-spliced rope. Braking is achieved by use of a bungee cord or by establishing a catenary (dip) in the cable as to achieve a gravity braking effect (Rohnke et al., 1994, p.128)

Delimitations

Delimitations of this study include:

- The population of this study is delimited to Oklahoma State University challenge course participants from 1994 – 1997.
- The sample being studied were all 12 years of age or older.
- The high elements of this study are delimited to incline log, grapevine, high balance beam, high swinging log, Chaplin shuffle, two Line Bridge, crows nest, cargo net, Burma bridge, leap of faith, and Heebie Geebie.

Limitations

Limitations of this study include:

- The data were recorded by humans (both participants and OSU staff) and, therefore, subject to inaccuracies and misrepresentations.
- The data were both primary and secondary in nature, which could lead to incomplete and incorrect data through misunderstanding of what constitutes a close call/near miss, exaggerated accounts by participants and data being inadvertently recorded and/or transferred incorrectly.
- This study may not have all data as some close call / near misses may have gone unseen by instructors or unreported by participants.

Assumptions

Assumptions of this study include:

- Close calls/near misses are not desired occurrences on challenge course high elements.
- Close call/near miss forms were filled out to the best of the instructors' ability.
- All data submitted by instructors and participants were accurate.
- University trained instructors provided consistent instruction to all participants, including uniform delivery of information regarding element/process description, transfer speech, and practice exercises.
- University trained instructors provided consistent data reporting.
- The review process, reporting and filing of data was accurate by the university's outdoor program staff.

CHAPTER 2

LITERATURE REVIEW

Experiential Education Theory

While the theoretical underpinnings of experiential education can be traced back to philosophers such as Socrates, Plato, and Rousseau, it was Johann Heinrich Pestalozzi's, *How Gertrude Teaches Her Children*, that ushered in a new thought about pedagogy. He said "children should not be given ready-made answers but should arrive at answers themselves...children should learn through activity and through things" (Smith, 2004). John Dewey later identified experience as "teacher" moving beyond, Pestalozzi's observations, redefining education in terms of experience (Dewey, 1938/1966).

According to John Dewey (1938) "...all genuine education comes about through experience..." (p. 25) Experience for Dewey includes a social relationship between the individual and the environment. These experiential relationships were no longer a series of unrelated interactions rather, Dewey proposed experiential relationships as replicable interactions through which meaning is constructed (Kraft & Kielsmeier, 1995). As a result of Dewey's work, experiential education began to develop theoretically.

Experiential education as an approach, has steadily gained support over the past 20 years, encompassing many different viewpoints (Luckner & Nadler, 1997). Fundamentally, it is based on the assumption that knowledge begins with an individual's

relationship to a topic. Luckner & Nadler state “experiential learning is a philosophical orientation toward both teaching and learning which appreciates and facilitates linkages between concrete educational activities and abstract lessons to maximize learning (Sakos & Armstrong, 1996).” (1997, p.3)

Dewey and other experiential education theorists generally agree on four phases in experiential learning: 1) experiencing; 2) reflecting; 3) generalizing; and, 4) applying. All stages are necessary in order for an instructor to facilitate an individual’s learning. In the first stage, *experiencing*, learning objectives are identified, and experiences either occur naturally or are facilitated in order to accomplish the identified objectives. In the second phase, *reflecting*, the experience is turned into experiential learning when individuals look back and examine what they saw, felt and thought about during the experience. This phase can consist of individual introspection in which new and old experiences are integrated, or a group process where the experience is clarified by discussion. In the third phase, *generalizing*, the structured experience is transferred to other situations and settings. In this phase, patterns are recognized and the situation is generalized in terms of what tends to happen or can potentially happen in a related or analogous circumstance, rather than what happened in the specific experience. In the fourth and final phase, *applying*, generalizations are put into action. In this phase attention is shifted from the specific experience to actual situations and settings in an individual’s daily life – making experiential learning practical and meaningful. As in every cycle, the last and first phases are connected; application is connected to experience in the sense that the application becomes part of an individual’s background knowledge for the next experience (Luckner & Nadler, 1997).

The experiential learning cycle provides experientially based programs with a consistent theoretical framework to develop successful programs: Druian, Owens, and Owen (Kraft & Kielsmeier, 1995) summarize a number of these components into nine categories:

1. Purpose: program content and education directives are clearly understood by staff members, and participants, furthermore, the relationship between educational need and content are demonstrable.
2. Setting: refers to the physical and psychological environments in which the learning takes place, the setting should contain four essential factors: realism, challenge, an appropriate level of risk and diversity.
3. Participant characteristics: learning characteristics such as sex, age, gender, ethnic background, economic status, preferred learning style, moral, and reasons for joining, participants should be voluntary and diverse.
4. Learning strategies: learning should be based on explicit learning theory, young participants should be encouraged to participate in activities normally given to more mature adults in society, a balance of action, reflection, and application should be emphasized, learning experiences should be individualized, sequential, and developmental, frequent structured interaction between student and instructor should be involved, and opportunities for unplanned learning from new experiences should be provided.
5. Student roles: students are active in planning and carrying out activities, have the opportunity to experience different roles, assume responsibility for own actions, and have the opportunity to interact with community adults and peers.

6. Instructor roles: effective instructors should help students plan and carry out their activities, provide role models as participants in the learning process, progress is monitored, and model skills in planning, empathy, communication, and resources sharing.
7. Learning activities: products and/or outcomes are perceived as real and important by participants and others, and participants feel ownership over the outcomes.
8. Management and support: in effective experiential programs, community resources are located for student learning, positive relationships are formed with external agencies, funding and community support are obtained, and committed staff are recruited.
9. Program outcomes: in general, outcomes should consist of increased participant self-confidence and ability to relate to others, participants and instructors are involved in assessing the effectiveness of the program, both positive and negative outcomes are examined along with areas for program improvement.

While the theory of experiential education has been developing over the course of several centuries, it is just in the last century that it has been put into practice. This theory brought entirely new meaning and power to the practices of teachers and students alike. The philosophies behind experiential learning served as a solid foundation for several innovative instructional techniques, which would bring learning, rather than teaching, to the forefront of the educational process. One such technique that stemmed from this strong and logical foundation was adventure education. Kurt Hahn built upon experiential education principles, incorporating the intrinsic value of challenge in education. From

this basic assumption, he highlighted adventure activities as powerful experiences for learning, forming adventure education.

Adventure/Outdoor Education

Kurt Hahn, as the father of adventure education, was profoundly influenced by many fathers of experiential education. His early interest in experiential education can be traced to Plato, while his later emphasis on ‘experiential therapy’ can be traced to Pestalozzi and Dewey (Hattie, Marsh et al. 1997; Smith, 2004). Kurt Hahn’s contributions to adventure education are significant, as his vision and dedication led him to form the Salem Schools, Gordonstoun public school, and Outward Bound, in addition to the Edinburgh’s Award Scheme and Atlantic Colleges.

Kurt Hahn’s vision seemingly came as an antidote for what he believed to be the ill of modern youth which he identified in 1930 as the “Six Declines of Modern Youth: 1) decline of *fitness* due to modern methods of locomotion; 2) decline of *initiative* and *enterprise* due to “spectatoritis”; 3) decline of *memory* and *imagination* due to the confused restlessness of modern life; 4) decline of *skill* and *care* due to weakened tradition of craftsmanship; 5) decline of *self-discipline* due to ever present availability of stimulants and tranquilizers; and, worst of all, 6) decline of *compassion* due to the unseemly haste with which modern life is conducted” (Flavin, 1996, p.15-17; Smith, 2005). Hahn’s vision encompassed what we now know as adventure education; fitness training focused on physical self competition by which the body would train the mind in discipline and determination, through challenging expeditions, by sea or land. Such expeditions were designed to test and build endurance, and included various projects,

service based or otherwise, which developed crafts and skill (e.g. rescue service, such as firefighting, First Aid, and lifesaving) (Smith, 2005).

From Hahn, adventure education has come to embody all of the philosophies and theories of experiential education with an adventure component. In general, it is the physical challenge and inherent components of the environment which are considered mechanisms of learning and/or change. One comprehensive conceptualization of adventure education is proposed by Baldwin, Persing, and Magnuson (2004): adventure education “is characterized by: (a) the planned use of adventuresome activities, (b) a real-life activity or learning context, (c) goal-directed challenges that must be solved individually and in groups, (d) an outdoor or wilderness setting, (e) cooperative small group living and activity participation, (f) trained leaders/facilitators, and (g) specific, pre-planned educational or developmental goals.” (p.168)

As implied in the above definition, one of the key components for adventure education is risk. Risk, as Webster’s defines it is: “exposure to the chance of injury or loss; hazard or dangerous chance” (p.1660). Implied in this definition are two types of risk: perceived and real. Both types of risk play pivotal roles in producing the fertile environment for change. Combined, perceived and real risk, generate two key areas of opportunity for the adventure participant: the task or activity to be achieved, and the environment in which the experience takes place.

First, perceived and real risk are present in the activity or task to be achieved, presenting participants with the opportunity for success and failure, which, according to Hahn’s Seven Laws of Salem School, are necessary for impact (Smith, 2004). This opportunity gives the participant the chance to discover for herself: how strong, smart,

and skilled she is, and in what ways she is challenged to learn, and do, and accomplish more. A chance at success or failure inherent in meeting a challenge with immediate consequences is a vital component of adventure education and experiential learning.

Second, perceived and real risk are associated with the unfamiliar environment, creating unique physical and social circumstances (Walsh & Golins, 1976, p.59).

According to Nadler (1993), these unfamiliar environments are crucial in eliciting a state of dissonance via a constructive level of anxiety, sense of the unknown, and perception of risk. The use of unique environments creates the opportunity for disequilibrium within the participant. This disequilibrium occurs when an individual becomes aware that the previous way of processing information or performing tasks is not applicable in this new circumstance and is required for change to occur in adventure experiences. Placement in a new and unfamiliar environment helps to break down individual barriers, while creating this dissonance and forging more cognitive connections for the participant (Nadler, 1993).

According to Ewert (1989), risk is one of the three key elements of an effective adventure program environment, providing participants the opportunity to experience dissonance or uncertainty, noting that risk, fear, and dissonance maintain significant roles in learning new skills and applying old skills to new situations. Other factors outlined by Ewert (1989) include: 1) the development of shared meaning emerges from shared experience and evolves over time; and, 2) a high level of engagement. Shared meaning contributes to a spirit of cooperation, which in an adventure setting serves to promote overall well-being of group members and attainment of desired outcomes. The development of shared meaning and cooperation are further strengthened by a high level

of engagement. This engagement is fostered in adventure activities as a result of the risk and excitement associated with the real life activities, which leads to heightened attention and enjoyment (Ewert, 1989).

Combining the basic premise of adventure activities with the experiential learning and therapeutic cycles, Hahn was able to create an adventure education theory and practice that is still modeled today (Hattie et al., 1997). Adventure education is a powerful agent of change, with its “greatest impact in the domain of self-concept for independence, confidence, self-efficacy, and self-understandings” (Hattie et al., 1997, p.16). Such impacts were magnified during follow-up reinforcement periods. The adventure program component effects on self-concept are found to be greater than those typically found in the classroom-based programs. (Hattie et al., 1997) Adventure education and training has been successfully employed in various environments, (i.e. therapeutic, leadership, and team development) to accomplish outcomes such as global self-concept, physical competence, trust, social competence, cooperative behavior, decision making, and personal accomplishment/success (Bladwin et al., 2004).

A primary issue with implementing adventure education programs is the associated capital outlay. Due to the travel, equipment, personnel, and insurance costs associated with designing and implementing adventure experiences, this experience-based educational technique is less accessible to a number of potential beneficiaries. As a means to remedy this problem, adventure educators implemented the idea of a challenge course, which simulated an adventure environment in order to create an adventure experience with the use of fewer resources (time and money).

Challenge Courses

Challenge courses are important in the realms of experiential and adventure education because they provide a powerful and effective experience for participants without the large time and pecuniary resource investments required of traditional expedition based experiences (Bunting & Donley, 2002). Increased accessibility and low investment have contributed to the spread of challenge courses over the past 30 years. This growth has created a diverse cross-section of participants who reap the benefits associated with a challenge course experience, including adolescents, college students, and corporate employees (Bunting & Donley, 2002, p.158).

Challenge Course History and Description. The first challenge course constructed and used as an adventure assessment tool was built in 1962 by Tap Tapley for the Colorado Outward Bound School (COBS) (L. J. Miner & Boldt, 1981). Tapley's course "was patterned after the military obstacle style course, and a similar prototype developed in Europe, by Outward Bound founder, Kurt Hahn" (Rohnke et al., 1994, p.3). Early courses were constructed in trees utilizing the natural topography and resources. From these natural resources, hemp rope was strung to provide bridges, multi-vines, and a variety of high course elements.

The next major transition for challenge courses was the formation of the Project Adventure organization, a core group with Outward Bound backgrounds came together in 1971. The first challenge course they constructed was located at Hamilton-Wenham Regional High School (Rohnke et al., 1994; Terry, 1998). The integration of challenge course and high school curricula set a new trend in both public and private education (Rohnke et al., 1994). New curricula were developed in areas of "physical education,

various area of education, recreation, therapy and organizational behavior” (Rohnke et al., 1994, p.3).

The type of groups that benefit from challenge courses has evolved with course construction and usage. At-risk programs were perhaps the front runners to discover benefit of incorporating the challenge course into various treatment programs. The programmatic success seen by the treatment programs have led outdoor education centers, colleges, universities, and camps to explore the ways in which a challenge course could maximize their student and camper experiences. (Rohnke et al., 1994)

The growth and interest of challenge courses by the middle 80’s found corporate groups, which traditionally spend millions of dollars each year on Corporate Adventure Training (CAT) and Experience-Based Training and Development (EBTD), flocking to challenge courses to reap the benefits of developing group cohesion and teamwork (Bunting & Donley, 2002; Priest & Gass, 1997). Although CAT and EBTD encompass many different adventure-based activities, there are five comprehensive areas: warm-up activities that foster socialization, specific team tool development by way of initiatives, high/low element challenge course, outdoor adventure/challenge pursuits, or other adventures corporate training which may not closely resemble adventure educational activities (Priest, 1996). The positive outcomes associated with challenge courses are just one deciding factor for groups to seek out challenge course experiences. Additional factors include the relatively low cost, minimal amount of time investment for an effective experience, no capital investment for facilities needed to provide the experience, and ease of accessing the resource as settings exist in local public and private schools, resorts, and many college campuses (Bunting & Donley, 2002; Rohnke et al., 1994). The

effectiveness and ease of access to challenge courses have contributed to high participant use rates which have continued to increase during past the forty years (Confer et al., 2003; Hale, 1990; Priest, 1996; Rohnke et al., 1994).

A Typical Day on the Challenge Course. A day on the challenge course begins with introductory/safety discussions, followed by ice breaker activities, stretches/warm-ups, tag games, problem solving, trust building activities, initiatives/low elements, concluding with an introduction and completion of high elements. Introductory/safety discussions consist primarily of course facts, rules, and regulations, along with individual and group participant safety. Ice breaker activities (i.e. name games) are designed to encourage participants to interact with one another and become more comfortable with their social and physical surroundings. Stretches and warm-ups promote safe preparations of the body, reducing the risk for athletic type injuries. Tag games increase the activity level of the bodies and minds of participants preparing them psychologically to begin breaking down social barriers, while creating a safe environment that begins to allow expressions of trust, and setting the foundation before advancing to more challenging activities. Problem solving and trust building activities engage the entire group by challenging each individual to create solutions and work through mental and physical dilemmas for the benefit of the group. Initiatives and low elements continue to build upon the trust and group dynamics of the previous activities with an increase in challenge by way of physical and mental difficulty, as well as additional responsibility for the physical and emotional safety of the group members. These activities may involve additional equipment and may require one or more group members to be on an element from one inch to sixty inches off the ground, utilizing group members as spotters (Gass, 1998). The

introduction of high elements includes: group and individual time at a practice station, a walk through of the entire high course, and finally, navigation through the actual course. A practice station is set-up as a miniature version of the transfer points on the high course, providing participants with an opportunity to practice the transfer and commands needed to safely traverse the high course; transfer commands are provided and practiced to ensure effective communication between the climber and the belayer, each participant practices the transfer sequence of moving from on belay point to a second which enables the participant to move from one high element to the subsequent element. Following the practice station a course walk-through and brief explanation of the high course elements is performed, offering the participants the opportunity to ask questions and to visualize how and where the skills they learned on the ground will be utilized on the high course. Finally, the group and individuals choose which section of the course they would like to attempt and progress through the high elements.

On the Oklahoma State course, participants begin the high elements in one of two locations: the south or north entrance. The south course begins with a dynamic belay up an incline log. After transferring to a static belay, the participant traverses the Multi-vine, balance beams, Chaplin shuffle, and Postman's bridge, transferring at each new element. The north course has a dynamic belay entry to a Cargo Net. After transferring to a static belay, participants navigate the Burma Bridge, an Incline Log, a Leap of Faith, and a Heebie Geebie, this progression requires a transfer to each new element. The courses come together at one concluding transfer point, the "crow's nest", which is stationed by a trained instructor. The crow's nest is the waiting place for participants to exit the course via the zip-line. The typical day ends with a closure activity involving the entire group.

Standards Related to Challenge Course Safety and Training. The use of natural fibers and resources found on site in early challenge course construction often lead to premature decay of elements, compromising the safety of participants. In addition, the use of harnesses, helmets, belay devices, and other safety equipment was not uniform from one program to the next, and on some courses, belay systems were non-existent (Rohnke et al., 1994). The introduction of challenge courses to the public and private education sectors, however, ushered in a new focus on construction and safety standards. The Association for Challenge Course Technologies (ACCT), established in 1993, currently provides a series of standards related to challenge course construction techniques and appropriate materials (e.g. telephone pole classifications, acceptable types and uses of hardware, etc.). In addition to these construction standards, the ACCT has also begun to provide members with a builder ranking system. Builders are placed into three different levels based upon the following criteria: level of experience, number of completed installations, and type of installations. The ACCT has been instrumental in developing safety standards in relation to course construction and is currently paving the way for national standardization of challenge course practices, and instructor training programs.

In terms of challenge course safety practices, the use of harnesses, dynamic and static belay systems, and helmets became rules rather than exceptions. The most common early belay system was the dynamic belay (see Chapter 1, Glossary of Terms for complete definition). The ease of setting a dynamic belay made it inexpensive and easy to set-up, as there was only a single fixed point needed to mount the belay. This single point could also incorporate the use of a galvanized aircraft belay cable with a pulley moving

horizontally allowing the climber to traverse from one element to another. The second style of belay that became popular is the static or 'rat tail' belay (See Chapter 1, Glossary of Terms for complete definition). The static belay attaches a fixed length tether to the climber by way of one or more locking carabiners. The tether, once connected to the climber, is connected to either a galvanized aircraft belay cable by-way of carabiner or pulley, or fixed belay point, such as steel bolts or other points suitable for supporting a climber's weight in case of an unexpected fall. The belay cable or fixed belay point receives the full load of a climber during a fall. The load is transmitted to the belay point through the climbing rope or tether that is attached to the climber's harness. This combination of equipment works to prevent the fallen climber from hitting other people, objects, or the ground.

The basic belay system has remained relatively unchanged since its introduction to challenge courses, still requiring a climber, harness, rope or tether, and a belay point. The area of greatest change, occurring on a contemporary course, is the utilization of state of the art materials and safety systems to insure the comfort and safety of participants on the course. Additionally, the longevity of the challenge course materials has increased. Modern courses utilize telephone poles in place of trees; hemp rope has given way to kern mantle nylon climbing ropes and galvanized steel aircraft cable; and the swami belt harnesses have been traded in for padded nylon climbing harnesses.

Training standards vary from one challenge course to another. In recent years there have been a number of organizations that have made attempts to form a unifying body of training practices. These attempts have largely been unsuccessful, however, a number of recommended practices have emerged throughout the challenge course

community, and been communicated via various publications, including Parallel Lines, Association for Experiential Education Standards and Accreditation manual, various ropes course safety manuals, conferences, etc. In general, challenge course facilitators are trained in two key areas: technical and facilitation skills. While most technical skills are course specific, there are some fundamental skills that have been identified and are recommended, such as: challenge course operations; knowledge and proper use of all safety equipment, harnesses, helmets, ropes, the proper technique for tying a climber into the rope, proper set-up of the belay, proper use of belay device and proper belay technique, verbal climbing commands, and emergency lowering techniques; initiatives/low ropes, sequencing, picking appropriate equipment and props for activities, spotting, etc; safety and environmental awareness, First-Aid/CPR, ability to identify weather and facility hazards and maintain participant safety and well being in an outdoor environment; and programming and administrative skills to ensure smooth delivery of programs (Priest, 1995). Facilitation skills are divided into four categories: recreational, educational, developmental, and therapeutic (Priest, 1995). The areas focused on in this paper include recreational and educational. The skill sets needed for these areas require competency in: delivery of a properly sequenced day in which activities are introduced, debriefed, reflected, and generalized to maximize the participants' experience and to meet the group's goals and objectives (Priest, 1995, 1996). Additional areas for Facilitator training include: specific workshops that teach and build new skills and practical experience working with groups. From this sort of training, facilitators learn how to create a sequence of events to provide maximum growth opportunities for challenge course participants. The programmed experience must be consistent with the

foundations of experiential learning theory – in the sense that, the challenge course experience follows one of the progressions of activities theory. Failure to properly sequence an experience may contribute to a participant developing a counterproductive perception of the risk (Davis-Berman & Berman, 2002).

In a ten-year research review, Camille Bunting and John Donley (2002) concluded, that results from 10 of 15 studies showed significant, positive changes in challenge course participants. In addition to these findings, research indicates challenge course participation contributes to overall effectiveness in teamwork, genuine concern for others, effective listening, decision making, self-concept, and self-esteem. (Bunting & Donley, 2002; Priest, 1996) This positive press has dramatically increased the number of challenge course participants over the years, warranting a closer look at challenge course safety. While challenge course safety has improved significantly in the past forty years, there are still “antagonists who have claimed these programs lack safety and quality control” (p.65), and the industry has continued to see a number of potential and actual accidents. It is important to further the industry’s safety knowledge in order to prevent potentially harmful situations in any way possible (Priest, 1996).

Incidents and Accidents

“Accident data are used to determine and categorize the types and causes of accidents, which in turn, can provide the catalyst for improvement.” (Leemon & Erickson, 2000, p.5). Incidents and adventure are symbiotic, in that, an adventure without some risk (real or perceived) leaves the adventurer wondering if an adventure really ever took place. Inevitably, this adventure-associated risk opens up many doors for accidents, warranting further investigation from adventure education professionals (Leemon &

Erickson, 2000). The anatomy of an accident was outlined by Dan Meyer and Jed Williamson as a matrix to aid accident investigators in developing a better understanding of the interplay between objective and subjective factors and the resulting accidents (Leemon & Erickson, 2000, p.13). This post-incident tool divided subjective factors into two components: unsafe acts and errors in judgment (see **Exhibit 1** in the Appendix). Unsafe acts are defined by Meyer and Williamson as actions that are: questionable at the time or clearly unsafe resulting in an accident or near miss (Leemon & Erickson, 2000). Errors in judgment are similar to unsafe acts in that the error in judgment maybe known at the time of the decision or shortly afterward as an accident has occurred due to the judgment (Leemon & Erickson, 2000).

Alan Hale (1983) was one of the first people to apply The Dynamics of Accident Theory to adventure programs and specifically, challenge course incidents (Hale, 1990; Leemon & Erickson, 2000). Similar to the Meyer-Williamson three category matrix, Hale's theory was divided into two categories, human hazards and environmental hazards (1989) (see **Exhibit 2** in the Appendix). The combined effect of those two areas produced what Hale identified as accident potential (1989). The equation presented by Hale has a three-fold use: 1) a planning tool to guide an individual and programmatic decisions from the field to the board room; 2) a teaching tool with a simple equation of $(A+B=C)$, which is easily communicated and generalized to everyday situations, enabling a diverse audience to benefit from the planning process; and 3) an analysis tool in which the equation guides the fact finding process throughout an entire organization, increasing the flow of communication and creating an environment of openness that is more likely to reduce future accident potential problems (1989).

The Hale model and the Meyer-Williamson matrix provide post-incident tools designed to probe into the details of the incident. The Meyer-Williamson matrix focuses primarily on the individual in an attempt to uncover the decisions, and circumstances which caused the event, while the Hale model provides numeric value for the factors to be multiplied which produces a value for understanding the risk of a given action, decision, or situation.

Incidents and Accidents on Challenge Courses. As mentioned in the Introduction, the rise in challenge course participants has contributed to a rise in actual and potential accidents. In an effort to facilitate the creation of safer challenge course experiences, two of the premier challenge course programs, Project Adventure and Alpine Towers, have published specific statistics regarding incidents and accidents on challenge courses.

Project Adventure (PA) divided accidents/injuries into three categories: lost time injuries, no lost time injuries, and medical incidents. “Lost Time” injuries were defined as injuries which result in at least one day lost from work or school following the day of the accident itself, and represented 29% of the accidents in the 20-year total. “No Lost Time” injuries were defined as less serious injuries that do not result in lost time away from work or school, and represented 67% of the 20-year total. “Medical” incidents consisted of incidents related to pre-existing conditions that were triggered while participating in an activity, and represented 3% of the 20-year total.

Alpine Towers International (ATI), established in 1989, specializes in construction and facilitation training for five company designed structures: a team development course (a series of low element like initiatives), the Alpine Tower (a single structure with various vertical obstacles to navigate while ascending), the Alpine Tower

II (a modification of the Alpine Tower), the Double-tree Diamond (a dispersed structure with two entry points to a series of high-elements), and the Giant Swing. All structures requiring a belay utilize a dynamic belay system. A total of 179 recorded accident and near miss incidents as of July 1999. According the report, the majority of the incidents occurred in one of six program areas: 1) on the swing; 2) ascending the Tower; 3) descending the Tower; 4) belaying; 5) participating in an initiative; or, 6) during a non-activity period on or around the base rails. Incidents that were unable to be categorized in one of the above areas (either not in one of the mentioned areas, or location was not reported), were placed in a seventh, “other/unknown” area.

Near Miss Incidents accounted for 46% of all incidents and accidents between 1989 and 1999. Of the 83 near miss reports, 27 were recorded in the ‘other/unknown’ area, 23 were associated with Tower ascension, 14 occurred while belaying, 7 were the result of participating in Swing elements, 6 were associated with descending Towers, 4 occurred during initiatives, and 2 occurred on or around the base rails. Belayers and spotters made the most common error - failing to perform their duties, they dropped people, without incident, 16 times.

Minor Accidents was the second most frequent type of incident associated with Alpine Towers. A total of 78 minor accidents were reported, accounting for 44% of the aforementioned total. Bumps and bruises were the most common outcome. The second most frequent was falling due to belayers and spotters who failed to catch participants, and/or tripping over various objects. The remaining minor accidents have the following source distribution: 19 occurred during Tower ascension, 18 occurred on the Swing, 15 occurred during both the non -activity periods near the base rails and in the

other/unknown category, 6 were associated with partaking in initiatives, 4 while descending the Tower, and one minor accident occurred while participants belayed.

In all of the serious accidents that were reported, participants sustained an injury that required professional medical treatment. Of the 18 reported serious accidents, there were 10 fractures, three lacerations, two instances of heat exhaustion, and one case of each of the following: fatigue, dislocation, and muscle injury. ATI reports that most serious accidents were the result of either unusual circumstances, or carelessness, and concluded that human error is the leading cause of incidents that occur during Alpine Tower program facilitation. For instance, many participants fail to report preexisting conditions or medications they are taking to program staff.

Most of the information collected, to date, concerning accidents in adventure education is post-hoc. While this information does provide a useful mechanism for planning for future safety in adventure activities, there are some things practitioners can do to be more proactive in accident prevention. Accidents (or near misses) must be described in relation to how they occurred in order that other practitioners can share in the learning, making for safer and better understood programming. By producing detailed documentation a balance maybe achieved to counter the negative impressions left by the critical discussion of safety in some of the literature (Miner, 1991). In addition to establishing the practice of producing detailed documentation, close examination of past records, where they are available, would also be a useful step all of which would foster a positive learning outcome for organizations (Miner, 1991). Near miss incidents, when well-documented, and reviewed on a regular basis are valuable predictors of future accidents (Leemon et al., 1998). This study makes use of this valuable information by

exploring the factors that contribute to potentially harmful challenge course situations.

The desired result is to prevent potentially harmful situations while enhancing learning potential of a challenge course experience.

CHAPTER 3

METHODOLOGY

Data are archival, consisting of incident forms filed between 1994 and 1997 within a mid-western university's challenge course. Incident forms are completed and filed by university challenge course instructors. Challenge course instructors are required to complete a standardized, 32-hour training and log a total of 24-hours of apprenticeship, during which the forms are explained and utilized. In addition, instructors receive continuing education via follow-up (lessons) at monthly instructor meetings and required annual re-certification trainings, completed between twelve to eighteen months following certification.

Population Profile

The population consisted of a total of 169 reports of individuals experiencing some sort of a "close call" or "near miss" during a challenge course experience. There were a total of 67 males, 89 females and 13 unknown gendered participants ranging in age from 11 years of age to 56 years of age with mean age of 19.46.

Independent Variables

Independent variables consist of element types with 11 levels, location of transfer with ten levels, type of incident with five levels, belay type with two levels, gender with two levels, and age with two levels. Type of element includes the following high

elements present on the OSU challenge course (complete definitions provided in Chapter 1, Glossary of Terms): Incline Log – South, Grapevine Traverse, Balance Beams, Chaplin Shuffle, Postman’s Bridge, Zip-line, Cargo Net, Burma Bridge, Incline Log – North, Leap of Faith, and Heebie Geebie. Type of transfers includes the following: Incline Log-South to Grapevine = Transfer Point 1, Grapevine to Balance Beam = Transfer Point 2, Balance Beam to Chaplin Shuffle = Transfer Point 3, Chaplin Shuffle to Postman’s Bridge = Transfer Point 4, Crow’s Nest = Transfer Point 5, Cargo Net to Burma Bridge = Transfer Point 6, Burma Bridge to Incline Log-North = Transfer Point 7, Incline Log-North to Leap of Faith = Transfer Point 8, Leap of Faith to Heebie Geebie = Transfer Point 9, and no transfer point = Transfer Point 0. Belay Type includes static and dynamic belay systems (complete definitions provided in Chapter 1, Glossary of Terms). Type of Incident included: unclips; slips, falls, or injuries; failure to complete the course, equipment misuse, and pre-existing medical conditions (complete definitions provided in Chapter 1, Glossary of Terms). Gender was separated into male and female. Age was separated into under 16 years of age and over 16 years of age.

Dependent Variable

The dependent variable is the frequency of incidents. Incidents are defined as potentially dangerous situations where safety was compromised but did not result in an injury. Incidents and Near Misses are recorded on Incident/Near Miss forms by the lead instructor or assigned personnel. All instructors are trained to recognize incidents and complete the forms with accurate and detailed information regarding the incident and all persons involved. Information contained on the forms include: date of incident, instructors present, participant name, age, group the participant was with, description of

the incident, listing of contributing factors (clothing, weather, ability, etc), and recommendations on future preventive actions. See **Exhibit 3** in the Appendix for a sample reporting form.

Statistical Treatment

All usable forms were compiled, data were hand coded, and manually entered into SPSS 12.0 for Windows for analysis. Data were coded based on the independent variables as follows: Type of Element: Incline Log South = 1, Grapevine = 2, Balance Beam = 3, Chaplin Shuffle = 4, Postman's Bridge = 5, Transfer Point = 6, Cargo Net = 7, Burma Bridge = 8, Incline Log North = 9, Leap of Faith = 10, Heebie Geebie = 11, Zip-line = 12; Transfer Points: Transfer Point 1= 1, Transfer Point 2= 2, Transfer Point 3= 3, Transfer Point 4=4, Transfer Point 5=5, Transfer Point 6=6, Transfer Point 7=7, Transfer Point 8=8, Transfer Point 9=9, Transfer Point 0 = 0; Belay Type: Static = 1, Dynamic = 2; Accident Type: Unclipping = 1, Fail to Complete Course = 2, Slip/Fall/Injury = 3, Equipment Misuse = 4, Pre-existing Medical Condition = 5; Gender: Male = 1, Female = 2; Age: Under 16 = 1, 16 and Over = 2.

The statistical treatment used to analyze the data was a Non-Parametric Chi-Square to test for significant differences ($\alpha = .05$) in frequencies along the independent variables. Data meet the assumptions for the Non-parametric Chi-Square in the following ways:

1. **The sample must be randomly drawn from the population.** Randomization is not of concern since the sample includes all incidents occurring between 1994 and 1997.

2. **Data must be reported in raw frequencies (not percentages).** The researcher was in possession of the raw data. Frequencies were tallied within the SPSS program in order to calculate the statistic.
3. **Measured variables must be independent.** There is only the potential for an incident and its associated components to fall into one category level of the variable along which it is observed. For example, one incident does not occur in more than one element location.
4. **Values/categories on independent and dependent variables must be mutually exclusive and exhaustive.** All observations were mutually exclusive (are able to exist independent of any other observations).
5. **Observed frequencies cannot be too small.** While the observed frequencies for some variable categories would be considered low, they seem to be counterbalanced by higher frequencies (within the same variable categories), which increase the expected frequencies to a more realistic range. Zero value cases were omitted on a test-by-test basis.

A Bivariate tabular (crossbreak) analysis was used as follow-up to gain further insight into the significant relationships found in the initial analysis. This technique enabled examination of each combination of variables in terms of frequencies, which were converted into percentages for interpretive clarity.

CHAPTER 4

RESULTS

The two purposes of this study were: 1) to discover the relationships between challenge course incidents and 2) to identify causal factors that contribute to or increase participant exposure to actual risk. Data were gathered and variables were identified as: type of element, type of transfer, type of belay, type of incident, gender, and age. Data were collected in the form of archived Close/Call Near Miss reports for the years, 1994, 1995, 1996, 1997. The following hypotheses were examined:

- HO₁ There are no differences in the number of incidents from one high element and another high element.
- HO₂ There are no differences in the number of incidents from one transfer station and another.
- HO₃ There are no differences in the frequency of incidents between static and dynamic belays.
- HO₄ There are no differences in the type of incidents.
- HO₅ There are no differences in the number of incidents between females and males.
- HO₆ There are no differences in the number of incidents from participants under the age of 16 and participants over the age of 16.

A total of 169 total incident forms were collected. Of this total, 32 forms were not usable because of inaccurate or inappropriate information, multiple incidents per form, or inaccurate use of forms (utilizing Close/Call form for reporting various personnel and facility problems), resulting in a total of 137 coded and entered forms. This study tested six null hypotheses. Significant differences were found between variables, allowing confident rejection of five of six null hypotheses. An alpha level of .05 was used for all statistical tests. (See Table 1 for summary of results). The null hypotheses that were addressed are as follows:

Table 1: Summary of Chi-Square

	Element Type	Transfer Point	Type of Belay	Type of Accident	Gender	Age
Chi-Square	237.444	365.970	83.851	43.985	4.699	0.123
df	10	8	1	4	1	1
Asymp. Sig.	<0.001	<0.001	<0.001	<0.001	0.030	0.726

HO₁ There are no differences in the number of incidents from one high element and another high element.

The first null hypothesis can be confidently rejected with a Chi-Square value of 237.444 (df = 10, p = .001), indicating significant differences between element types. Of the 137 forms coded and entered, 4 of the forms were not used because of missing data, total number of forms used 133. (See Table 2 for summary of results). Follow-up frequencies analysis revealed 2.9% of the incidents occurred while on Incline Log – South, 24.8% occurred while on the Grapevine, 2.9% occurred while on the Balance Beam, 0.7% occurred while on the Chaplin Shuffle, 38.7% occurred while on the Transfer Point, 4.4% occurred while on the Cargo Net, 14.6% occurred while on the

Burma Bridge, 0.7% occurred while on the Incline Log-North, 1.5% occurred while on the Leap of Faith, 1.5% occurred while on the Heebie Geebie, and 4.4% occurred while on the Zip Line.

Table 2: Chi-Square Frequencies for Element Type

		Frequency	Percent	Chi-Square Observed N	Chi-Square Expected N
Valid	Incline Log South	4	2.9%	4	12.1
	Grapevine	34	24.8%	34	12.1
	Balance Beam	4	2.9%	4	12.1
	Chaplin Shuffle	1	0.7%	1	12.1
	Transfer Point	53	38.7%	53	12.1
	Cargo Net	6	4.4%	6	12.1
	Burma Bridge	20	14.6%	20	12.1
	Incline log North	1	0.7%	1	12.1
	Leap of Faith	2	1.5%	2	12.1
	Heebie Geebie	2	1.5%	2	12.1
	Zip Line	6	4.4%	6	12.1
	Total	133	97.1%	133	12.1
Missing System	4	2.9%			
Total	137	100.0%			

HO₂ There are no differences in the number of incidents from one transfer station and another.

The second null hypothesis can be confidently rejected with a Chi-Square value of 365.970 (df = 8, p = .001), indicating significant differences between transfer stations. Of the 137 forms coded and entered, 3 of the forms were not used because of missing data, for a total of 134 forms. (See Table 2 for summary of results). Follow-up frequencies analysis revealed 56.9% of the incidents did not occur on a transfer, 3.6% occurred while on Transfer Point 1, 2.2% occurred while on Transfer Point 2, 1.5% occurred while on

Transfer Point 3, 1.5% occurred while on Transfer Point 4, 26.3% occurred while on Transfer Point 5, 2.2% occurred while on Transfer Point 6, 2.2% occurred while on Transfer Point 7, and 1.5% occurred while on Transfer Point 8. (See Table 3 for summary of results).

Table 3: Chi-Square Frequencies for Transfer Points

		Frequency	Percent	Chi-Square Observed N	Chi-Square Expected N
Valid	None	78	56.9	78	14.9
	Transfer Point 1	5	3.6%	5	14.9
	Transfer Point 2	3	2.2%	3	14.9
	Transfer Point 3	2	1.5%	2	14.9
	Transfer Point 4	2	1.5%	2	14.9
	Transfer Point 5	36	26.3%	36	14.9
	Transfer Point 7	3	2.2%	3	14.9
	Transfer Point 8	3	2.2%	3	14.9
	Transfer Point 9	2	1.5%	2	14.9
	Total	134	97.8%	134	
Missing	System	3	2.2%		
Total		137	100.0%		

HO₃ There are no differences in the frequency of incidents between static and dynamic belays.

The third null hypothesis can be confidently rejected with a Chi-Square value of 83.851 (df = 1, p = .001), indicating significant differences between belay types. Of the 137 forms coded and entered, 4 of the forms were not used because of missing data, for a total of 133 forms used. Follow-up frequencies analysis revealed 87.6% of the incidents occurred on a static belay, 10.2% occurred while on a dynamic belay. (See Table 4 for summary of results).

Cross-tabulation between belay type and type of element showed the following differences: Incline Log South: 100% of the incidents occurred on dynamic belay; for the

following elements, 100% of the incidents occurred on static belay: Grapevine, Balance Beam, Chaplin Shuffle, Burma Bridge, Incline Log North, Leap of Faith, Heebie Geebie; Transfer Point: 91% of the incidents on static belay, 9% of the incidents on dynamic belay; Cargo Net: 20% of the incidents on static belay, 80% of the incidents on dynamic belay; Zip Line: 80% on static belay, 20% of the incidents on dynamic belay. (See Table 5 for summary of results).

Table 4: Chi-Square Frequencies for Belay Type

		Frequency	Percent	Observed N	Expected N
Valid	Static	120	87.6%	120	67.0
	Dynamic	14	10.2%	14	67.0
	Total	134	97.8%	134	
Missing	System	3	2.2%		
Total		137	100.0%		

Table 5: Cross-tabulation for Type of Belay x Element Type

Type of Belay	Element Type											Total
	Incline Log South	Grapevine	Balance Beam	Chaplin Shuffle	Transfer Point	Cargo Net	Burma Bridge	Incline Log South	Leap of Faith	Heebie Geebie	Zip Line	
Static	0	34	4	1	48	1	20	1	2	2	4	117
Dynamic	4	0	0	0	5	4	0	0	0	0	1	14
Total	4	34	4	1	53	5	20	1	2	2	5	131

H_{O4} *There are no differences in the type of incident.*

The fourth null hypothesis can be confidently rejected with a Chi-Square value of 43.985 (df = 4, p = .001), indicating significant differences between types of incidents. Of

the 137 forms all forms were coded and entered. Follow-up frequencies analysis revealed 29.9% of the incidents occurred as an unclipping, 27.7% occurred as a failure to complete the course, 29.2% occurred as a slip, fall, or injury; 10.9% occur as misuse of equipment; and 2.2% occurred as pre-existing medical condition. (See Table 6 for summary of results).

Cross-tabulation between belay type and type of incident showed the following differences: 85% of unclipping incidents occurred on static belay, and 15% on dynamic belay; 87% of the failure to complete incidents were on static belay, and 13% were on dynamic belay; 97% of the slip, fall, or injury were on static belay, and 3% were on dynamic belay, and 86% of the equipment misuse incidents were on static belay, and 14% were on dynamic belay; 100% of the pre-existing medical condition incidents occurred on static belay. (See Table 7 for summary of results).

Table 6: Chi-Square Frequencies for Type of Incident

		Frequency	Percent	Chi-Square Observed N	Chi-Square Expected N
Valid	Unclipping	41	29.9	41	27.4
	Failure to Complete	38	27.7%	38	27.4
	Slip, Fall, or Injury	40	29.2%	40	27.4
	Equipment Misuse	15	10.9%	15	27.4
	Pre-existing medical condition	3	2.2%	3	27.4
	Total	137	100.0%	137	
Missing	System	0	0.0%		
Total		137	100.0%		

Table 7: Cross-tabulation for Type of Incident x Type of Belay

		Unclipping	Failure to Complete Lowered on request	Slip, Fall, or Injury	Equipment Misuse	Pre-Existing Medical Condition	Total
Type of Belay	Static	34	33	38	12	3	120
	Dynamic	6	5	1	2	0	14
Total		40	38	39	14	3	134

HO₅ There are no differences in the number of incidents between females and males.

The fifth null hypothesis can be confidently rejected with a Chi-Square value of 4.699 (df = 1; p = .030), indicating a significant difference in the frequency of incidents between males and females. Follow-up frequency analysis revealed the following. Of the 137 incidents, 57.7% were females, and 39.4% were males (2.9% of the forms were not used because of missing data). (See Table 8 for summary of results).

Cross-tabulation between gender and type of element showed the following differences: Incline Log South: 25% males, 75% females; Grapevine: 28% males, 72% females; Balance Beam: 25% male, 75% female; Chaplin Shuffle; 100% female. Transfer point: 60% male, 40% female; Cargo Net: 33% male, 67% female; Burma Bridge: 45% male, 55% female; Incline Log North: 100% female; Leap of Faith: 100% female; and Heebie Geebie: 100% female (See Table 9 for summary of results). Cross-tabulation between gender and transfer point demonstrated the following differences: Transfer Point 1: 60% males, 40% females; Transfer Point 2: 67% males, 33% females; Transfer Point 3: 50% males, 50% females; Transfer Point 4: 50% males, 50% females; Transfer Point

5: 63% males, 37% females; Transfer Point 6: 33% males, 67% females; Transfer Point 7: 100% females; Transfer Point 8: 50% male, 50% females (See Table 10 for summary of results). Cross-tabulation between gender and belay type showed the following differences: static belay: 41% males, 59% females and dynamic belay: 36% males, 64% females. (See Table 11 for summary of results). Cross-tabulation between gender and incident type showed the following differences: Unclipping: 59% males, 41% females; Failure to Complete: 14% males, 86% females; Slip, Fall, or Injury: 41% males, 59% females; Equipment Misuse: 46% males, 54% females; and Pre-existing Medical Condition: 100% males. (See Table 12 for summary of results).

Table 8: Chi-Square Frequencies for Gender

		Frequency	Percent	Chi-Square Observed N	Chi-Square Expected N
Valid	Male	54	39.4%	54	66.5
Valid	Female	79	57.7%	79	66.5
	Total	133	97.1%	133	
Missing	System	4	2.9%		
Total		137	100.0%		

Table 9: Cross-tabulation for Gender x Element Type

		Incline Log S.	Grapevine	Balance Beam	Chaplin Shuffle	Transfer Point	Cargo Net	Burma Bridge	Incline Log N.	Leap of Faith	Heebie Geebie	Zip Line	Totals
Gender	Male	1	9	1	0	31	2	9	0	0	0	0	53
	Female	3	23	3	1	21	4	11	1	2	2	5	76
Total		4	32	4	1	52	6	20	1	2	2	5	129

Table 10: Cross-tabulation for Gender x Transfer Points

		Transfer Point 0	Transfer Point 1	Transfer Point 2	Transfer Point 3	Transfer Point 4	Transfer Point 5	Transfer Point 6	Transfer Point 7	Transfer Point 8	Transfer Point 9	Totals
Gender	Male	22	3	2	1	1	22	0	1	0	1	53
	Female	53	2	1	1	1	13	0	2	3	1	77
Total		75	5	3	2	2	35	0	3	3	2	130

Table 11: Cross-tabulation for Gender x Belay Type

		Type of Belay		
		Static	Dynamic	Total
Gender	Male	47	5	52
	Female	69	9	78
Total		116	14	130

Table 12: Cross-tabulation for Gender x Type of Incident

		Unclipping	Failure to complete	Slip, Fall, or Injury	Equipment Misuse	Pre-Existing Medical Condition	Total
Gender	Male	24	5	16	6	3	54
	Female	17	32	23	7	0	79
Total		41	37	39	13	3	133

HO₆ There are no differences in the number of incidents from participants under the age of 16 and participants over the age of 16.

The sixth null hypothesis can **not** be confidently rejected with a Chi-Square value of .123 (df = 1; p = .726), indicating no significant difference between participants under the age of 16 and participants 16 years of age and older. Of the 137, 7 forms were missing age indicators for a total of 130 forms identified the total number of participants

under the age of 16 was 63 (46.0%) and the number of participants 16 and older was 67 (48.9%). (See Table 13 for summary of results).

Table 13: Chi-Square Frequencies for Age

		Frequency	Percent	Chi-Square Observed N	Chi-Square Expected N
Valid	Under 16	63	46.0%	63	65.0%
Valid	16 and Over	67	48.9%	67	65.0%
	Total	130	94.9%	130	
Missing	System	7	5.1%		
Total		137	100.0%		

CHAPTER 5

SUMMARY, FINDINGS, AND DISCUSSION

The results provide a number of valuable insights that have practical applications in the following areas: challenge course design, facilitator training, program development, program delivery, and programmatic philosophy. Each of these areas directly impacts the service being delivered to challenge course participants. More specifically, the results from this study aid in the design of more powerful and effective challenge course structures; facilitate the development of proper training programs for challenge course facilitators; and cement a foundation for an adventure education program philosophy to the end of creating more successful, lasting learning experiences for challenge course participants.

Incident Location

In terms of incident location, the highest number of incidents occurred on Transfer Points. In general, this indicates that there is something of interest with transfers, since the transfer point provides the participant an opportunity to be completely “unclipped” from the belay, exposing them to an unacceptable level of actual risk. It is the perception of risk, rather than actual risk which plays an important role in the learning experience, including vital components such as autonomy/empowerment and responsibility (making it impractical to remove this component from a course altogether).

Therefore, the primary implication for this finding exists within the facilitator training, program delivery components of an experience, and philosophy of the program. It may be that instructors need to be trained differently, or participants need to be instructed differently with regard to transfers between elements. Programmatic philosophy should directly impact training and program delivery, as all three of these areas need to be in concert to deliver consistent program content, yielding consistent results in regards to participant safety and group goal attainment.

Findings related to the specific type of element provided a number of interesting results. The Grapevine yielded the highest number of incidents, (24.8%), on an element followed by the Burma Bridge (14.6%). On each side of the course (North and South), these elements are the first in which the participant is on a static belay. The transition to a new system could be a contributing factor to the increased number of incidents on these two elements.

The primary implication for these findings lies in the course design area. Such a high number of incidents at the onset of a course does not prepare participants for success; the potential feelings of failure accompanying an incident early on could compromise the learning that would have taken place otherwise (and/or has already taken place). While both actual and perceived risk are inherent to this part of the experience (i.e. on a static course, participants are empowered to care for themselves and their fellow participants by being responsible for the transfers to new belay systems without direct instructor contact, fostering greater self-esteem and independence, as well as group care), some actual risk exposure may be circumvented by better course design. Results show that the elements demonstrating the lowest levels of incident are North/South Incline

Log, Balance Beam, Chaplin Shuffle, Leap of Faith, Heebie Geebie, all of which are primarily balance based, and provide a means of balancing (via the static belay rope). Placing less demanding elements such as these at the onset of a course may decrease the potential for incidents, while increasing the potential for success, and maintaining the important factors of independence, responsibility and risk, which make the overall experience more effective.

In combination, the data indicates that the choice of sequenced high elements for a challenge course contribute to the course's ability to create misadventure, failing to both, provide an experience which meets the goals of the participants, and fulfill the mission of the organization. These factors may be mitigated by the training and experience of the challenge course staff, which contribute to their ability to properly read and assess a group and provide a sequence of events that sets the group up to achieve their desired goals. If the "perceived risks of a situation are too high for a participant", the first person attempts the course and fails, "the impact can be counterproductive, at best and damaging at worst" (Davis-Berman & Berman, 2002, p.308).

Transfer Location

Despite the fact that the Crow's Nest is staffed by a trained challenge course instructor, the number of incidents occurring on the Crow's Nest was greater than all other incidents on transfers combined. In fact, the presence of a challenge course instructor in conjunction with the location and construction of the Crow's Nest (a large platform at the course's end) may actually contribute to the increased number of incidents. The first factor to consider is participant exhaustion. As the course's finale, the Crow's Nest provides the first location on the course for participants to take a minute to

rest and reflect on what she has just completed. Such physical and mental exhaustion alone may result in some degree of carelessness. In addition, the large platform for standing and the presence of a trained instructor may contribute to an increased level of comfort, while decreasing the level of participant rigidity associated with safety precautions. While each of these factors (exhaustion and increased comfort levels) individually have the potential to increase incidents, results from this study demonstrate that they could possibly come together at the Crow's Nest to have a more powerful impact.

Alternatively, the direct instructor observation may contribute to increased reporting, potentially providing a more accurate reflection of the number of incidences which occur while transferring. On a course with potentially six or more participant transfers occurring, it is difficult for one or two instructors to clearly see each transfer. Once the participant makes her way to the large platform, the instructor has an opportunity to directly observe the transfer and the individual's proper use or misuse of equipment. This up close, one-on-one observation by a trained instructor may contribute to a higher number of incident reports, potentially indicating that the number of incidents reported on other course locations is lower than the number of actual incidents. The placement of an instructor on every transfer platform is not logical or practical, the implications of this finding boils down to facilitator training and program presentation. In either case, particular emphasis must be placed on transfer locations as risky in order to ensure that instructors and participants alike exhibit extra caution at transfer points.

Type of Incident

The Type of Incident variable included here is one that has not been researched in the challenge course safety studies. Of the five types, “Unclipping” incidents were the single highest type of incident, closely followed by “Slips, Falls, and Injuries” incidents with “Failure to Complete the Course” incidents as the final incident of concern. The number of unclips is of particular interest as a single incident in that, this type of incident is not a malfunction of the equipment as much as it is misuse of the equipment or procedural failure. The fact that it appears to be an operator error warrants the thought that the immediate probable causes could be instruction techniques, staff to participant ratio, type of belay utilized, amount of time dedicated to teaching, amount of time practicing the skill set, and/or sequencing of instruction. Such potential causes warrant more careful consideration of programming, instructor training, and program presentation.

Belay Type

The number of incidents for static belay was ten times higher than dynamic belay incidents. The difference in this instance may be somewhat mathematically biased in the sense that the course contains only two dynamic transfers, compared to seven static transfers. It is important, however, to more closely examine the observed results. Chances are good that when under the direct supervision of an instructor (which is the case for all dynamic belay transfers), fewer incidents would occur. As previously mentioned, empowering participant pairs (one on the element and one on the ground) with the responsibility of belay transfers may be an integral portion of the learning experience. This

aspect of the course should therefore not be excluded, but rather given the necessary attention during instruction and practice time for participants.

Gender

The information gained from the gender results was very interesting from a number of perspectives. First, overall, over half (57%) of the incidents involved females. Second and third, stark differences between males and females arise when examining the top three incident locations, and when examining the top three incident types. Regarding Incident Location, cross-tabulation showed that males were involved in the majority of incidents on the transfer points, while females were involved in the majority of the incidents on the Incline Log and Burma Bridge. As for Type of Incident, the majority (59%) of the “Unclipping” incidents involved males, the majority (86%) of the “Failure to Complete” incidents involved females, and the majority (59%) of the “Slip, Fall, or Injury” incidents involved females. While there are a number of gender difference issues (social, emotional, developmental, etc.) to which these findings may be attributable, these factors are beyond the scope of this study, and are therefore not discussed. The practical implications for the purposes of this study are: 1) the earlier assertion that the Grapevine and Burma Bridge elements may require more upper body strength, contributing to the respective difficulty is further supported, warranting careful consideration of course construction, 2.) both programming and staffing of challenge course experiences should take into consideration the gender make-up of the participating group, and 3.) some gender difference/sensitivity issues may need to be included in facilitator training.

Age

Although there were not statistically significant differences between selected age groups, closer examination of some findings do have practical implications for challenge course experiences. More specifically, with regard to the type of incident, results showed that the majority (66%) of “Unclipping” incidents involved participants under the age of 16, while the majority (69%) of the “Slip, Fall, or Injury” incidents involved participants over 16 years of age. With this in mind, it is not surprising that the majority of the incidents occurring on transfer points involved participants under 16 years of age.

Implications Summary

In summary, the above findings result in (four) primary implication areas for challenge course programming: course construction; instructor training; staffing and programming; and program philosophy.

Course construction and layout. The sequencing of high elements that demand significant upper body strength as entry points impacts participant success ratios. Course layouts may need to be assessed and modified to increase success ratio and reduce injury potential and risk exposure.

Instructor Training. In general, results indicate a need for modification and incorporation of new procedures or equipment that re-enforce correct transfer sequence, including the refinement of the high course introduction and walk-through process. Additionally, the planning/programming needs for groups under the age of 16 and over the age of 16 need to be explored. These two groups have their own unique programmatic needs as each have different levels of experience, maturity, self-care skills, and gender specific issues.

Staffing and Programming. The instructor to participant ratio has an effect on the amount and type of instruction a participant may receive. The increasing numbers of participants in one group on the course may impact the program quality and function. The competing factors of time (fewer instructors/more participants) and money (larger groups/fewer instructors) impact the amount of time an instructor would have to spend working with any one individual if they were to be identified as needing additional time to practice or needing a different style of instruction. Increasing the number of available instructors for a group would increase the level of supervision. Furthermore, the increased number of instructors actively working with groups under experienced instructors increases the overall level of instructor quality, which directly impacts the quality of experience a group may receive.

Program Philosophy. The drive of a program is the programmatic philosophy: why; what; and how will they accomplish the mission of the organization. This driving force is sometimes usurped by individuals within the organization and/or the organization itself. The push to have the largest course, the desire to make more money than last year, and the chance to have the highest number of participants all contribute to the organizational climate. Such a climate may be in opposition to the stated mission of the organization. The inconsistency between organizational mission and program delivery may increase the likelihood that training and staffing are not geared to meet the originally intended goals, which means that participants are not receiving the program as it was originally designed and subsequently are not likely to meet their desired group goals.

The Godsey Risk Exposure Matrix

In the interest of providing programmers with a practical tool to meet the goals of participants (a powerful, injury-free experience) and the fulfillment of the organizational mission (providing powerful injury-free experiences), the information from some of the most practical variables (Gender, Age, Belay Type, and Type of Incident) included in this study has been synthesized to create the Godsey Risk Exposure Matrix.

The Godsey Risk Exposure Matrix combines the four aforementioned variables, providing a quick reference for likely risk exposures. Based on a cross-tabulation including a combined Age and Gender variable in relation to Belay Type at a level of Incident Type (see **Exhibit 4** in the Appendix), the matrix examines and combines the variables to predict the Type of Incident (see Figure 1). This matrix can be utilized by instructors and course management as a tool that recommends areas for special instruction or increased instructor to participant ratio. The instructor team now has the ability to respond to a particular population's needs and goals more effectively - ultimately increasing the overall success of the group.

Figure 1: Godsey Risk Exposure Matrix

		Belay System		
		Dynamic	Static	
Gender & Age Group	<16	None	Unclipping	
	Male	
		>16	Unclipping	Slip, Fall, & Injury
	Female	<16	Unclipping Failure to Complete	Failure to Complete
	
		>16	Fail to Complete	Slip, Fall, & Injury Failure to Complete

Recommendations for future research

This study has laid a solid foundation for empirical investigation of challenge course safety. As with any empirical investigation, replication and further validation are always beneficial. The results with implications in challenge course construction, for example, warrant further replication on a variety of courses. In addition, from the well of results presented here, has sprung several new areas for investigation.

First, the findings related to the age variable warrant further, more specific investigation. A closer look at the cross-tabular analyses (see **Exhibit 5** in the Appendix) could prove beneficial in terms of staff preparation and instruction, pointing to potential issues of cognitive processing, maturity, and coordination. Potential research questions include: Is there a connection between developmental and cognitive abilities and sequential learning in an outdoor environment (and the increased number of

distractions)? Controlling for all other factors (course construction, instructor training, etc.), how young is too young? What are the outcomes for various age groups?

Second, many of the findings point to modification of instructor training, opening doors to explore the impact of instructor training and experience on challenge course safety: What is the effect of instructor experience level on groups success? Is there a relationship between instructor experience and incidents on high elements challenge courses? How do we create mental and physical challenges with a successful and safe outcome, without losing the integrity of the experience while achieving the identified learning outcome? How does different training content and format impact challenge course incidents?

Finally, results related to gender differences initiate questions from both internal and external perspectives. Internally, how do gender differences (social, emotional, physical, and developmental), relate to challenge course incidents? Externally, how do training and programming for gender specific needs impact the success of a group? And, how can we balance gender specific programs in co-ed groups?

Concluding Remarks

These research areas and questions merely scratch the surface of the information to be collected regarding challenge course experiences. We know as adventure educators that compromised safety yields compromised learning, therefore the outcome is misadventure. Without better understanding of the factors that play a role in the safety of participants, it is not useful to study the learning outcomes of adventure education programs. It is important for adventure education researchers to “get back to the basics” in order to lay a firm foundation for investigating the true outcomes of adventure

education. More insight regarding how we create a safe experience is the first step in designing an effective adventure learning program.

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APPENDIX

Exhibit 1: The Meyer-Williamson Accident Matrix

Potentially Unsafe Conditions Due to:	Potentially Unsafe Acts Due to:	Potential Errors in Judgment Due to:
<ul style="list-style-type: none"> · Falling objects (rocks, etc) · Inadequate area security · Weather · Equipment/Clothing · Swift/cold water · Animals/plants · Physical or psychological profile of participants &/or staff 	<ul style="list-style-type: none"> · Inadequate protection · Inadequate instruction · Inadequate supervision · Unsafe speed (fast/slow) · Inadequate food/drink · Poor position · Unauthorized/improper procedure 	<ul style="list-style-type: none"> · Desire to please others · Trying to adhere to a schedule · Misperception · New or unexpected situation · Fatigue · Distraction · Miscommunication · Disregarding instincts

Exhibit 2: The Hale Accident Matrix

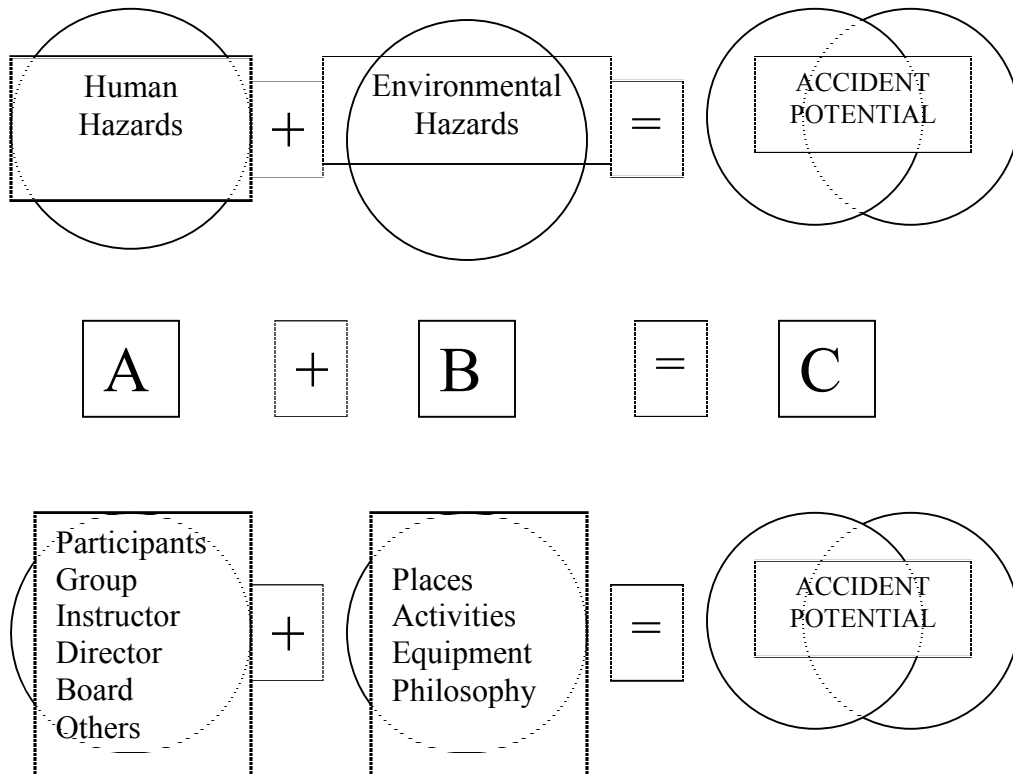


Exhibit 3: OSU Close Call/Near Miss Form

**OSU CHALLENGE COURSE
CLOSE CALL/NEAR MISS
REPORTING FORM**

GENERAL INFORMATION

DATE _____

INSTRUCTORS _____

INCIDENT/PARTICIPANT INFORMATION

GROUP _____

PARTICIPANT APPROX. AGE _____ MALE FEMALE

DESCRIPTION OF INCIDENT (WHAT HAPPENED, HOW IT WAS
DELAT WITH, THE EXACT LOCATION, WHICH INSTRUCTOR
HANDLED IT, ETC.)

GENERAL INFORMATION

LIST ANYTHING (WEATHER, PROPS, CLOTHING, PARTICIPANT
ABILITIES, ETC.)

WHICH MAY HAVE CONTRIBUTED TO THIS INCIDENT
OCCURRING.

RECOMMENDATIONS

WHAT CAN WE DO TO PREVENT THESE TYPE OF INCIDENT
FROM HAPPENING?

Exhibit 4: Cross-tabulation for Godsey Risk Exposure Matrix

Type of Accident	Type of Belay	Gender X Age				Totals
		Males Under 16	Males Over 16	Females Under 16	Females Over 16	
Unclipping	Static	16	4	5	6	31
	Dynamic	1	2	2	1	6
	Total	17	6	7	7	37
Failure to Complete	Static	3	1	14	11	29
	Dynamic	1	0	2	2	5
	Total	4	1	16	13	34
Slip, Fall, or Injury	Static	5	10	5	16	36
	Dynamic	0	0	0	1	1
	Total	5	10	5	17	37
Equipment Misuse	Static	3	2	1	4	10
	Dynamic	0	1	0	1	2
	Total	3	3	1	5	12
Pre-existing Medical condition	Static	0	3	0	0	3
	Dynamic	0	0	0	0	0
	Total	0	3	0	0	3

Exhibit 5: Cross-tabulations for Age

Cross-tabulation for Age x Element Type

Age Group	Element Type											Total
	Incline Log South	Grapevine	Balance Beam	Chaplin Shuffle	Transfer Point	Cargo Net	Burma Bridge	Incline Log North	Leap of Faith	Heebie Geebie	Zip Line	
Under 16	3	14	1	0	34	3	4	0	1	0	2	62
16 and Over	1	19	1	1	17	3	15	1	1	2	4	65
Total	4	33	2	1	51	6	19	1	2	2	6	127

Cross-tabulation for Age x Type of Incident

Age Group		Unclipping	Failure to Complete	Slip, Fall, or Injury	Equipment Misuse	Pre-Existing Medical Condition	Total
		Under 16	25	20	12	6	0
16 and Over	13	15	27	9	3	67	
Total		38	35	39	15	3	130

VITA

Jon-Scott Godsey

Candidate for the Degree of

Master of Science

Thesis: CHALLENGE COURSE SAFETY: A STUDY OF MANAGEABLE
FACTORS CONTRIBUTING TO INCIDENTS ON HIGH ELEMENTS

Major Field: Health, Physical Education, and Leisure

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Personal Data: Born in Denver, Colorado, on October 24, 1968, the son of Linda Bowlby and Randy Godsey.

Education: Graduated from John Marshall High School, Oklahoma City, Oklahoma in May 1987; received Bachelor of Arts degree in Philosophy from University of Oklahoma, Norman Oklahoma in August 1994. Completed the requirements for the Master of Science degree with a major in Leisure Services Management at Oklahoma State University in July 2005.

Experience: Raised on a farm near Tuttle, Oklahoma; employed by Oklahoma State University, Department of Campus Recreation, Outdoor Adventures as a graduate assistant; Oklahoma State University, Department of Campus Recreation, 1996-98; employed by University of Nebraska – Lincoln, Department of Campus Recreation as an Assistant Director for Outdoor Recreation, 1998 to present.

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Name: Jon-Scott Godsey

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Institution: Oklahoma State University

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Title of Study: CHALLENGE COURSE SAFETY: A STUDY OF
MANAGEABLE FACTORS CONTRIBUTING TO
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Pages in Study: 71

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Scope and Method of Study: The two purposes of this study were: 1) to discover the relationships between challenge course incidents and 2) to identify causal factors that contribute to or increase participant exposure to actual risk. Data were gathered and variables were identified as: type of element, type of transfer, type of belay, type of incident, gender, and age. Data were collected in the form of archived Close/Call Near Miss reports for the years, 1994 through 1997 (n = 137). The statistical treatment used to analyze the data was a Non-Parametric Chi-Square to test for significant differences ($\alpha = .05$) in frequencies along the independent variables. A Bivariate tabular (crossbreak) analysis was used as follow-up to gain further insight into the significant relationships found in the initial analysis.

Findings and Conclusions: Significant differences were found between variables, allowing confident rejection of five of six null hypotheses. The variables: Type of Element ($\chi^2 = 237.444$), Transfer Point ($\chi^2 = 365.970$), Type of Belay ($\chi^2 = 83.851$), Type of Incident ($\chi^2 = 43.985$), and Gender ($\chi^2 = 4.699$) were found to have significant differences at each of the corresponding levels. The results provide a number of valuable insights that have practical applications in the following areas: challenge course design, facilitator training, program development, program delivery, and programmatic philosophy. More specifically, the results from this study aid in the design of more powerful and effective challenge course structures; facilitate the development of proper training programs for challenge course facilitators; and cement a foundation for an adventure education program philosophy to the end of creating more successful, lasting learning experiences for challenge course participants.

ADVISER'S APPROVAL: Dr. Christine Cashel
