Wizards of Motion: Evaluation of a Helmet Intervention Program

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Abstract

Introduction

Lakehead University's Wizards of Motion program is designed to introduce students to the application of mechanics to the analysis of human motion. The Wizards Grade 7 helmet intervention module provides a unique opportunity for students to visualize the outcomes of unsafe practices while studying specific concepts within the Grade 7 Ontario Science Curriculum. The purpose of this study was to evaluate the implementation and utilization of the Wizards Intervention module

Methods

Seventy four students from five Grade 7 Northwestern Ontario schools participated in this quasi-experimental research study. Thirty seven students participated as the intervention group, while thirty seven students comprised the control group. The intervention group was required to complete a knowledge test of basic biomechanical concepts and helmet safety, and a survey of attitudes and frequency of helmet use pre and post intervention. In addition, students and teachers in the intervention group completed program satisfaction questionnaires. Students in the control group completed a knowledge test, and attitude and helmet use surveys during the same time period.

Results

The results were organized into three themes: Program Implementation, Program Outcomes, and Value Added. The Program Implementation results indicate that the program was implemented as intended, the educational practices were incorporated

effectively, and the teachers were provided with the support necessary to make the program a success. The Program Outcome results suggest that while there was no significant difference in the pre to post test comparisons on attitude towards helmet use between control and intervention groups, there was a statistically significant increase in the level of knowledge for the intervention group. There was a significant difference in the intervention versus control group's intention to wear a helmet in the future. The results of the Value Added theme suggest that both students and teachers found the program a valuable addition to their classroom.

Conclusions

The success in delivering the "Wizards of Motion" program illustrates the versatility of linking real time health promotion to standardized curriculum, and invites considerations for additional program links across the curriculum. Finally, the study highlights the importance of programs designed to promote head safety and helmet use.

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Introduction

Wizards of Motion Program

Lakehead University's Wizards of Motion program, funded by National Science Engineering and Research Council (NSERC) PromoScience program is designed to introduce the application of mechanics to the analysis of human motion. Scientific and technical experts in biomechanics, education and computer science visit Grade 7 and Grade 10 Northwestern Ontario classrooms with portable, self-contained laboratory experiences that focus on measuring kinematic and kinetic variables associated with human movement. The Wizards of Motion curriculum links closely to the Ministry of Education science curriculum but expands to human motion applications and hands-on quantitative data experiences. Students collect and analyze data and create customized reports with animated graphic displays. The program also provides support to teachers to expand their science delivery programs and to encourage student interest in the science of human motion.

The objectives of the Wizards of Motion program are to:

- Provide an exciting and interactive introduction on the application of mechanics to human movement.
- Motivate and encourage interested youth to consider pursuing post secondary education in the science of human movement, specifically focusing on the application of mechanics to human motion. Related areas of study include kinesiology, industrial and occupational biomechanics, ergonomics, and biomedical engineering.

- Provide teachers with enriched science modules involving hands on technology and interactive activities in order to teach and captivate the interest of their students.
- Provide professional development for science teachers to utilize the web based data analysis tools and follow up learning activities.
- Foster interest in applied scientific research.

While the Wizards of Motion program has two distinct curriculum packages, one for students in Grade 7 science and one for students taking the physics strand of the Grade 10 academic science curriculum, the focus of this research is on the core module prepared for Grade 7. The purpose of the Wizards of Motion Grade 7 presentation is to provide an exciting, interactive head safety module which links directly to the following Grade 7 Ontario Science Curriculum Expectations:

- Demonstrate an understanding of the relationship between the effectiveness of structural forms and the forces that act on and within them.
- Design and make a variety of structures, and investigate the relationship between the design and function of these structures and the forces that act on them.
- Demonstrate an understanding of the factors (e.g. availability of resources) that must be considered in the designing and the making of products that meet a specific need.

The Grade 7 students use a custom designed Head Impact Measurement System (see Figure 1) to simulate falls and subsequent head impact. The measurement system is comprised of a support frame and a mounted head-form with attached linear accelerometers. The device is interfaced to a laptop computer for analogue to digital data conversion. The procedure enables students to observe and compare kinematic and kinetic variables associated with head trauma based on impact. At the end of the program the students should be able to:

- Define and identify basic biomechanical terms and concepts, determinants of head injury and safe head practices.
- Discuss the characteristics of materials used to dampen or absorb force.
- Generate and interpret data from the head impact measurement system and relate them to the design of protective helmets.
- Discuss the specifications of helmets used to protect the head while playing hockey, in-line skating, or cycling.
- Articulate an increased interest in practicing safe helmet use behaviors.

The purpose of this study was to evaluate the implementation and utilization of the Wizards of Motion Helmet Intervention module presented in Grade 7 science classrooms.

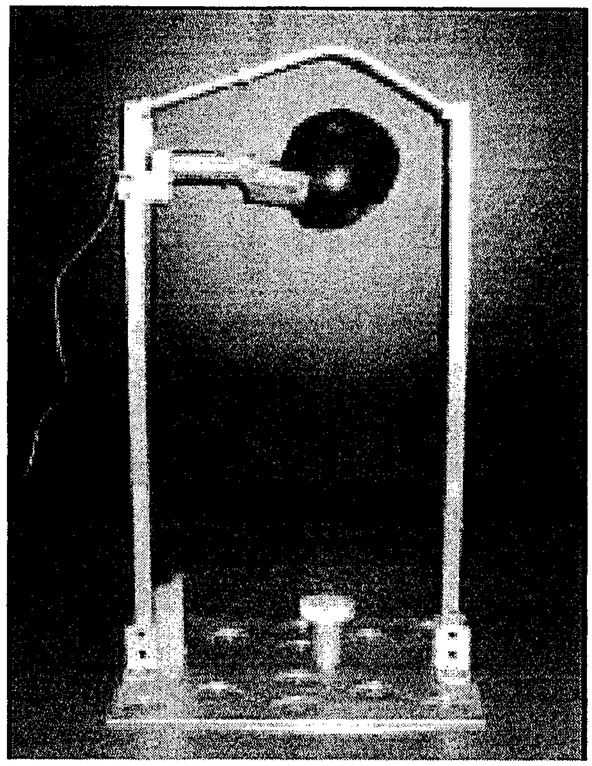

Figure 1. Head Impact Measurement System

Review of Literature

It is commonly recognized that injury prevention and the development of programs that promote safety are central tenets of public health. Similarly, promotion of participation in sport and recreation at all levels of society is a major emphasis of public health promotion. Yet participation in sport and recreational activity is not without risk of injury. For example, the Canadian Institute of Child Health (CICH) reported that unintentional injuries are the leading cause of death and a major cause of injury in children and adolescents. Likewise, in 2002, the World Health Organization reported that over 700,000 children ages 14 and under were killed due to injuries, of which 90% were classified as unintentional (as cited in Safe Kids, n.d). Among the risks associated with participation in sport and recreation is the risk of head injuries.

In Canada, the Canadian Institute for Health Information reported that in 2003/2004, participation in sport and recreation was the third leading cause of hospital admission due to traumatic head injuries for children and youth (CIHI, 2006). Clinical studies of moderate to severe head injuries show that the consequences can include impairment of cognitive, emotional, social and physical functioning.

Just as participation in sport varies by gender, so too does the head injury rate. According to the Public Health Agency of Canada (2000) the top five sports or recreation activities where males sustain head injuries are as follows: snowboarding (29.5%), downhill skiing (25.4%), football (15.9%), rugby (14.6%) and skateboarding (13.2%). The top five sport or recreation activities where females sustained head injuries were as follows: horseback riding (31.7%), downhill skiing (19.1%), sledding (15.7%), bicycling

(11.5%) and soccer (10.3%). Although there is little research devoted to the cause of injury in some of the above mentioned activities, there is considerable information related to participation in cycling both at the competitive and recreational levels.

There are several sources of currently published statistics which describe the incidence and prevalence of cycling related injuries. For example, according to SmartRisk – an NGO safety advocacy group, there were 1266 Ontario cyclists hospitalized in 2002-2003 due to cycling related injuries. The impact of these injuries becomes more profound when one considers that this rate of hospitalization accounted for more that 5000 days in acute care hospital treatments (SmartRisk, 2006).

With respect to head injuries, the safety advocacy group: ThinkFirst reported that cycling is the leading cause of hospitalization due to head injuries among school age children (ThinkFirst, 2005), while Safe Kids Canada, also a safety advocacy group, reported that traumatic brain injury accounts for some 29% of hospitalizations due to cycling related admissions. Yet as most research has indicated that the risk of head injuries related to cycling can be reduced considerably by simply ensuring that cyclists wear size and age appropriate helmets. Early studies by Thompson and Rivers (1980) reported that helmets reduce the risk of head injury by 85% and the risk of brain injury by 88%, findings which were later supported in research by Finnoff, Laskowski, Altman, and Diehl (2001). Despite that it is the law in most provinces in Canada that adolescents under the age of 18 years wear a CSA approved bicycle helmet when cycling on public paths, recreation trails and roadways, the ThinkFirst organization reported that only 55% of individuals between the ages of 11-14 reported that they always wore a helmet when cycling (ThinkFirst, 2005). Yet how important is the notion of head protection to an adolescent? According to the Canada Safety Council the top ten reasons youths reported for not wearing a helmet included either they just don't bother /or that a helmet negatively affected their appearance (14%), helmet users are not cool (13%), helmets are uncomfortable (11%), unaware of the dangers / inconvenient (10%), don't need to / don't believe they will have an accident / don't like to be made to wear one / not mandatory or it wasn't in the past (6%), look stupid / forget (5%) and like danger / bad habit / stupidity / carelessness (4%) (Canada Safety Council, 2002).

Interventions Designed To Promote Head Safety and Helmet Use

Many of the provincial governments in Canada have decided that regulating the use of helmets is an important and effective way to prevent injuries, and have therefore created helmet legislation for bicycle use. In 1995, Ontario's provincial government implemented a legislation which requires all people under the age of 18 to wear a helmet when riding a bicycle on a public road. As of June 2005, the following Canadian provinces have some form of bicycle legislation: British Columbia, Alberta, Ontario, New Brunswick, Nova Scotia and Prince Edward Island (ThinkFirst, 2005). In a Canadian wide study, bicycle related injuries decreased significantly with the implementation of helmet legislation in comparison to non-legislated provinces. (Macpherson, To, Macarthur, Chipman, Wright, & Parkin, 2002).

In the ten years since Ontario passed its legislation requiring helmet use, the education surrounding helmet use has been limited. A Private Members Bill 129 was introduced into Parliament in 2004 in order to require cyclists of all ages to wear a helmet. Bill 129 also required helmets to be worn when riding a vehicle powered by muscular power (Legislative Assembly, 2004). To date, the legislative amendment has not been accepted, but the discussion on legislation has helped place helmet safety on the agenda of many different Associations across Ontario. The Canadian Association for Sports Medicine, the ThinkFirst Foundation, and the Canadian Association of Road Safety Professionals have published position papers stressing the need for educational programs to be implemented. The January 2005 revision of the Toronto Public Health's Bicycle Safety Teacher's Package includes lesson plans and activities for students covering all aspects of bike safety, including helmet use.

A study conducted by Leblanc, Beattie and Culligan (2002) showed that the implementation of bicycle helmet legislation in Nova Scotia led to a significant increase in the rate of helmet use. When Nova Scotia implemented the legislation, a mass education blitz occurred for the following two years. Education programs alone were shown to be effective encouraging helmet use for about 50% of the population. There was significant improvement when education was combined with legislation (Macpherson, 2002; Svanstrom, Welander, Ekman, & Schelp, 2002).

A number of community-based programs have been conducted and report increased helmet use after the intervention. An example of this is the MORE HEALTH Bicycle Safety Project (1995) which was implemented in Florida and included a presentation and reduced price helmets for public school students. The presentation included hands on activities involving the use and effectiveness of helmets. The curriculum goals focused on teaching students about the purpose of a bike helmet, and on demonstrating bicycle safety. Classroom teachers evaluated the pre and post program activities, program content, instructional aid, instructor's rapport with the students, instructor's presentation, instructor's enthusiasm, and instructor's knowledge of the area.

To determine helmet use, pre and post observational surveys were conducted at nine elementary schools where the program was implemented and also at nine schools that were matched based on location and demographics to form the control group. The results indicated that, overall, teachers were very impressed with the program. The suggested areas for improvement included providing preprogram material earlier, enhancing readability of material, and encouraging preparation of in class colouring book. Post program data showed that 1008 helmets were sold through the program. The results suggest that prior to the program there was not a significant difference in helmet use between the control and the intervention groups. The post-test results suggest that only 8.5% of control group participants were wearing a helmet when biking, compared to 21% of the participants in the intervention group. This results suggests that there was a significant difference in post-test helmet use between the control and the intervention groups ($p>0.01$) (Liller, Smorynski, McDermott, Crane, & Weibley, 1995).

Although the amount of helmet use has been studied directly following the intervention programs, there have been very few studies that have looked at the long term follow up of the helmet use and knowledge retention. One such intervention entitled "Safety Central" was introduced in the United States. The purpose of this study was to identify if there was an association between participation in the program and safety knowledge retention and helmet behaviours in 4th grade students. The study used questionnaires to obtain the student's retention of the materials presented in the program, and an observational instrument to determine helmet usage. Overall the results suggest that the program had a lasting effect on the retention of knowledge and helmet use (Davis Kirsch & Pullen, 2003).

Science Education

The importance of science and technology education has grown tremendously over the last few decades. The world we live in is constantly changing and therefore schools must continue to produce educated citizens capable of shaping our society. In a study conducted by Einsiedel (1989), Canadian's were surveyed to determine their basic scientific knowledge and attitudes towards science. The results suggested that Canadians were lacking in their science knowledge, with only half of the respondents knowing that it took the sun a year to travel around the earth, and over two thirds of Canadian's were not able to name a Canadian scientist. Although the respondent's scientific knowledge was lacking, they did value science as a positive force in their life. In regards to gender, females tended to score lower in the science knowledge than males (as cited in Tausig, 1990).

A working paper published by Crocker (1990) analyzed science education in Canada. It was hoped that this study would be used to improve the education system and teaching methods. The paper highlighted the issue of lack of coherence between the provincially run education systems. Provinces are responsible for governing their own elementary and secondary education. This paper suggested that there is greater congruency between provinces at the higher grade levels, than in the lower grade levels. Also at the lower grade levels, teachers do not necessary have any specific science qualifications. In the younger grades females tend to be over represented in the teaching role, and as discussed previously in the study by Einsiedel, females also score lower on the knowledge survey (as cited in Tausig, 1990).

In 1987, research by Ivany, Sherwood, and Widen, discussed a four year study that looked into the past and present components of science education in Canada. The purpose of the study was to make recommendations for future improvements in science education in Canada. The study suggests that there is a large gap between the goals of the science curriculum and what is actually accomplished. The authors indicated that science should be made more accessible to all students, and the curriculum should link to the student's everyday life.

Later research by Robitaille and Taylor (2001) suggested the increased interest in science education during the previous 10 plus years was not in vain. The purpose of the study was to compare and contrast teaching and learning of elementary and secondary students around the world. Data was collected in both 1995 and 1999. In regards to student achievement, of 38 participating countries only five countries had science scores that were significantly higher than the Canadian scores. Also, Quebec and Ontario scores improved significantly between the 1995 and 1999 data collections.

Over the 20 years since the Science for Every Student paper, the importance of science education is still garnering attention. Currently, the National Science Engineering Research Council [NSERC] science program provides funding for groups to promote and inspire young students in the area of science and engineering.

> The science century is here. Powerful new ideas and sophisticated research strategies and tools mean huge advances ahead in human knowledge. To be part of it, Canada's young people need access to hands-on science skills. PromoScience provides support for organizations opening science and engineering doors for Canada's young people. If you are helping young minds ask

big questions, ask us how we can help (National Science and Engineering Research Council. (2006).

Drawing From Evaluation Theory And Relating It To A School Science Intervention With A Public Health Message

The American Heritage Dictionary of the English Language (1996) defines evaluation as an action "to ascertain or fix the value or worth of" something (p.18). According to Doll, Bartenfeld and Binder (2003), injury prevention evaluation can be classified into two categories, intervention research and program evaluation. Intervention research involves "systematic investigations conducted to create generalizable knowledge about effective injury prevention interventions" (Doll et al., 2003, p.52). On the other hand, program evaluation is "usually practitioner-driven, providing credible information on whether to implement, improve, continue, or expand a specific intervention program rather than generating knowledge that is generalizable to other situations" (Doll et al., 2003, p.53).

Many theories exist to describe how evaluation should occur. According to Alkin and Christie (2004) evaluation can be broken down into three branches: use, value and methods. Each branch requires a different approach to how subsequent evaluation should occur. In Evaluating Training Programs: The Four Levels, Kirkpatrick (1998) suggests that there are four levels to evaluating training programs: reaction, learning, transfer, and results. The reaction level involves how the participants liked or disliked the program. Many programs utilize this level when looking to improve the program. The evaluation tool is normally a survey asking participants what they liked or didn't like, and what they would improve or change for next time. Kirkpatrick goes on to suggest that a negative experience at the reaction will have a negative effect on the learning level. The second level of evaluation, learning, is used to evaluate the extent to which the participant's knowledge and skills have increased. Kirkpatrick suggests that the best way to evaluate the learning stage is to use a pre-test/post-test experiment. The third level of evaluation is transfer. This measures the extent to which the participant has adapted their behavior to reflect the learning that has occurred: are the participants using the skills, knowledge acquired. The final level described by Kirkpatrick focuses on results. Kirkpatrick's book was written from a business perspective, and therefore the results stage is described as the bottom line.

Effective learning environments are those which facilitate acquisition of both objective and subjective learning outcomes. Subjective learner outcomes include perceived satisfaction, and/or changes in attitudes toward a specific topic or discipline. Objective learner outcomes are extrinsic and may be represented by quantitative measures. Objective learner outcomes may include completion of the learning experience (a binary score), or an improvement in the course grade as determined by a standardized measurement tool or program specific test (Stark, Gruber, Renkl & Mandl, 1998).

Although the learner outcomes, both subjective and objective, are important to examine, there is also a need to examine individual learning outcomes in relation to the student's perceptions of the tasks set, their level of engagement with them, and their interaction with the facilitator. The role of students' perception of what they learned cannot be over emphasized. If they did not value the experience, however cognitively productive it was, they will avoid it in the future (Scanlon et al., 1998, p. 13).

Scriven's contribution to evaluation theory suggests that evaluators need to place value or worth on what is being evaluated; "Bad is bad and good is good and it is the job of evaluators to decide which is which" (p. 19, Scriven, 1986). Scriven believed in the science of valuing, and that evaluation is just that (Alkin, & Christie, 2004). He also believed that evaluators who do not make a judgment, but provide information for others to make the decision are doing a great disservice to the evaluation exercise (Scriven, 1983). In direct contrast to Scriven's belief that it is the evaluator's job to place value (good or bad), Stufflebeam (1983) and Patton (1986) support the idea of use and improvement in terms of evaluation.

Stufflebeam is most widely known for his evaluation theory entitled CIPP model (1983). The CIPP (Context, Input, Process and Product) model focuses on both the process and the product. Context evaluation involves identifying needs to decide upon program objectives. Input evaluation leads to decisions on strategies and designs. Process evaluation consists of identifying shortcomings in a current program to refine implementation. Product evaluation measures outcomes for decisions regarding the continuation or refocus of the program. (Alkin & Christie, 2004, p.44). Stufflebeam believes that evaluation should be a continual process which provides information on the improvement on the program.

Patton's Utilization-Focused Evaluation (U-FE) Theory (1986) places a high importance on the results of a program evaluation, opposed to the value (good or bad) of a program. The U-FE does not suggest what areas must be assessed, but focuses on the involvement of the stakeholder or primary users. U-FE is a "process for making decisions about these issues in collaboration with an identified group of primary users focusing on their intended uses of evaluation." (Patton 2002). The emphasis is on the intended use by the intended users. Patton (2002) believes that by involving the primary stakeholders in the evaluation process they will be more apt to use the evaluation findings once it is completed.

In order to address the evaluation, implementation and utilization of the Wizards of Motion Helmet Intervention module in Grade 7 science classrooms, a multi-layered content framework for the interactive learning experience was created to help guide the assessment and evaluation of the Wizards of Motion Helmet Intervention program. Patton's Utilization-Focused Evaluation theory was chosen to provide the underlying framework for this evaluation in order to provide information about the implementation and outcomes to help the stakeholders improve the program.

Methodology

Purpose of the Study

The purpose of this study was to evaluate the implementation and outcomes of the Wizards of Motion Helmet Intervention module. A multi-layered content framework for the interactive learning experience was created to help guide the assessment and evaluation of the Wizards of Motion Helmet Intervention program.

Wizards of Motion Program Delivery

The Wizards of Motion Program introduces participating teachers to the material and technology that will be presented during each school visit. The program delivery team leads the teachers through the activities, providing them with the opportunity to ask questions, and provide opinions on how they think the material/activities will be received by the students.

The program is delivered to the students during a two hour block. The program starts with an introduction of concepts using a Power Point presentation using videos and animation to help capture the student's attention. The concepts and terms introduced include kinesiology, biomechanics, force, impulse, shock absorption and safe helmet design and practice.

Approximately halfway through the presentation the first activity, an egg toss, is introduced. Students are asked to postulate whether an egg can be thrown into a suspended bed sheet hard enough to break the egg. Two students are then asked to hold the sheet while one of the program delivery team members throws the egg as hard as possible into the sheet. The egg will not break because the sheet increases the amount of time over which the force acts on the egg. The magnitude of the force acting on the egg is reduced and the time over which the egg is brought to a rest is increased. This example is used as a starting point for discussion related to force, shock absorption, and injury.

Students are then introduced to the Head Impact Measurement System, custom designed to simulate falls and subsequent head impact. The measurement system is a miniature replica of the Canadian Standards Association (CSA) helmet testing equipment that has been designed and built though collaboration between the Kinesiology and Engineering faculties at Lakehead University. The system demonstrates concepts such as force measurement, mechanics of impact, shock absorption, the effectiveness of helmets and promotes discussion on the patho-physiology of Mild Traumatic Brain Injuries.

The head form is first dropped without any protective headgear, from a fixed height. The velocity at impact, along with the "g" force is measured for each trial. The head form is then fitted with a variety of protective helmets from selected sports, and dropped from the fixed height. Again, the velocity at impact, along with the vertical "g" force, is measured for each trial.

The results are presented to the students graphically and interpreted in the context of the magnitude of the forces relative to various forms of head injuries. The importance of proper fit is also demonstrated in this learning module.

After the program has been completed teachers are left with follow-up activities. By providing an opportunity to explore the science behind how helmets function as a protective mechanism, it is hoped the students will then be able to make informed decisions regarding their use.

Utilization Focused Evaluation Flow Chart

Patton (2002) provides a flowchart in his book, Utilization-Focused Evaluation (2 ed.), which was used as the basis for this evaluation. The first section of the flowchart deals with the identification of stakeholders in the project. The following list contains all of the identified stakeholders for this program:

- Lakehead University
- Wizards of Motion Program Implementers
- National Science Engineering and Research Council
- Lakehead District School Board
- Principals and classroom teachers of the involved classrooms
- Students
- Injury prevention groups/committees

The second phase of Patton's Utilization-Focused Evaluation flowchart is the collaboration between the evaluator and the stakeholders to determine the scope and questions the evaluation will address. After a series of meetings with stakeholders, the following content framework for evaluating the Wizards of Motion – Helmet Intervention module was created (Figure 2). It is based on previous models developed to address outcomes and practices in web-based delivery programs (Billings, 2000; McPherson & Montelpare, 2004). The development of this framework guided both the delivery and the evaluation of this program. The framework was used to create the research questions and evaluation strategy.

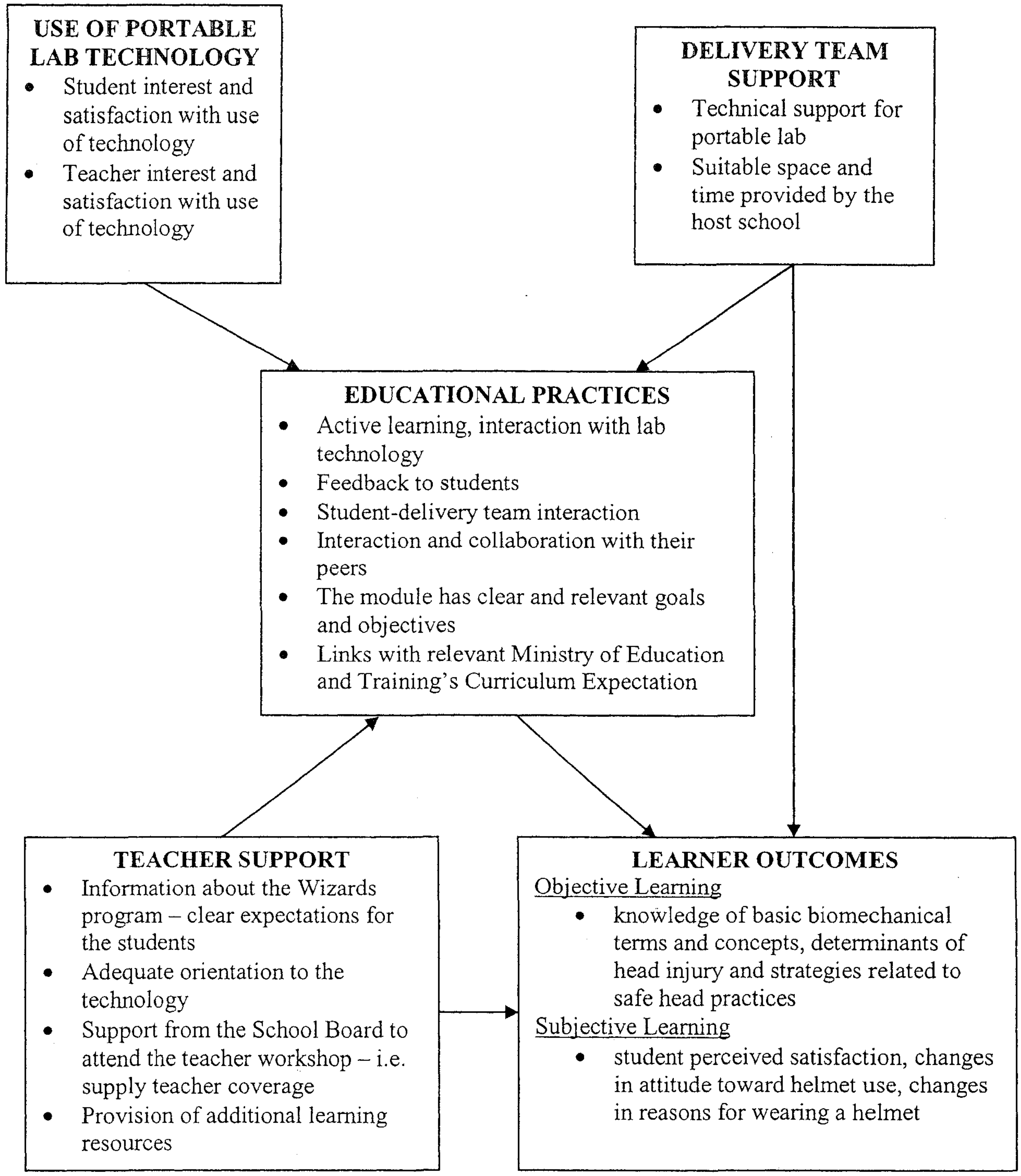

Figure 2. Framework for Evaluating the Wizards of Motion – Helmet Intervention Module
(Adapted from Billings 2000, McPherson & Montelpare 2004)

Research Questions

The research questions identified for this thesis can be divided into three areas; implementation, outcome and value added. The "implementation" research questions were used to determine if the program was implemented as intended. The "outcome" research questions were used to determine if there was a change in the student's knowledge, attitudes and helmet use. The questions focusing on the Outcomes program coincide with Kirkpatrick's second and third levels of evaluation. The "value added" research questions were used to determine areas in which changes could be made to enhance the Wizards of Motion Helmet Intervention Module and they represent Kirkpatrick's reaction level of evaluation.

Implementation.

1. Did the teachers report that there was adequate support provided from both the delivery team and the Lakehead Board of Education to successfully complete the Wizards of Motion Helmet Intervention module?
2. Was there adequate time, space and technical support to allow for the complete delivery of the module?
3. Were the educational practices used incorporated into the Wizards of Motion Helmet Intervention module effectively?

Outcome.

4. Did the participants in the program show a significant increase in knowledge of basic biomechanical terms and concepts, determinants of

head injury and safe head practices in comparison to the non-program participants?

5. Did the students show a change in their attitudes related to helmet use?
6. Did students show a change in the reasons that they expressed for why cyclists should wear a helmet?

Value added.

7. Did the students and teachers feel the portable lab technology added value to the Wizards of Motion Helmet Intervention module, and ultimately to their science class?
8. Did the students and teachers feel the Wizards of Motion - Helmet Intervention program added value to their science curriculum?

Research Strategy

Table 1. Research Strategy

Research Question	Variable of Interest	How to Assess	When to Assess
IMPLEMENTATION			
#1	Program Information	- Teacher Satisfaction Questionnaire	- End of Program
	Orientation to technology	- Teacher Satisfaction Questionnaire	- End of Program
	Program support from school board	- Teacher Satisfaction Questionnaire	- End of Program
#2	Suitable space and time provided by the host school	- Delivery Team's Log	- End of Program
	Technical support for portable lab	- Delivery Team's Log	- End of Program
#3	Active learning, interaction with lab technology	- Student Satisfaction Questionnaire - Teacher Satisfaction Questionnaire - Delivery Team's Log	- End of Program
	Feedback to students	- Student Satisfaction Questionnaire - Teacher Satisfaction Questionnaire - Delivery Team's Log	- End of Program
	Student-delivery team interaction	- Student Satisfaction Questionnaire - Teacher Satisfaction Questionnaire - Delivery Team's Log	- End of Program
	Interaction and collaboration with their peers	- Student Satisfaction Questionnaire - Teacher Satisfaction Questionnaire - Delivery Team's Log	- End of Program
	The module has clear and relevant goals and objectives	- Teacher Satisfaction Questionnaire	- End of Program
	Links with relevant Ministry of Education and Training Curriculum Expectation	- Teacher Satisfaction Questionnaire	- End of Program
OUTCOME			
#4	Change in student knowledge of basic biomechanical terms and concepts, determinants and head injury and strategies related to safe head practices	- Knowledge Based Test	- Before Program - End of Program
#5	Changes in student attitudes towards helmet use	- Student Helmet Questionnaire	- Before Program - End of Program
#6	Changes in student reasoning for wearing a helmet	- Student Helmet Questionnaire	- Before Program - End of Program
VALUE ADDED			
#7	Student and teacher interest and satisfaction with use of technology	- Student Satisfaction Questionnaire - Teacher Satisfaction Questionnaire	- End of Program
#8	Students and Teachers perceived satisfaction with the program	- Student Satisfaction Questionnaire - Teacher Satisfaction Questionnaire	- End of Program

Informed Consent Procedures

Approval from two Ethic Review Committees was required for completion of this study. The first ethics proposal was submitted to the Lakehead University Research Ethics Board and addressed the harm and potential risks to participants, deception, benefits to participants, dissemination of research results, research partners and graduate students, peer review, storage of data, and procedures to ensure anonymity and confidentiality.

The second ethical approval required was from the Lakehead Public Schools Board of Education. The process involved submitting a package with the following information: title of research, name of researcher, position of researcher, name faculty advisor or organizational supervisor, brief abstract of research project, type of research, data collection techniques, schools to be contacted, sample & size, budget, time, legal implications, and anticipated outputs of documentation. The package was submitted to the Superintendent responsible for research in early December, 2006.

Once ethical approval was obtained from both the Lakehead University Research Ethics Board, and the Lakehead Public Schools Board of Education, information and consent forms were distributed to the participating schools (Appendix 1). Due to the age of the students, both the participant's signature and the signature of the parent/guardian was required. If parental consent was not obtained the participant was allowed to partake in the Wizard's of Motion program, but they were not allowed to participate in the data collection.

Participants

This study involved seventy-four students from five Grade 7 classrooms in the Thunder Bay area in the 2006/2007 school year. Two classrooms, made up of a total of thirty seven students, were provided the Wizards of Motion program. Three classrooms, made up of a total of thirty seven students, made up the control group and did not receive the Wizards of Motion program.

Instruments

This study used four unique instruments in order to evaluate the student's head safety knowledge, their attitude towards helmet use, and the student and teacher satisfaction with the program.

The first instrument was the Knowledge Based Test (Appendix 2). The test was developed based on the objective learning outcomes identified in the Helmet Intervention Module description. Due to the novelty and uniqueness of the situation, a valid and reliable instrument did not previously exist. Therefore, the knowledge based test was developed by the researcher in conjunction with the other program implementers. After the knowledge based test was created a panel of six Grade 7 science teachers were asked to review and critique the test. They were asked for feedback in regards to the content, wording, and difficulty of questioning. Once the feedback from the teachers was received, the researcher revised the test. The test consists of 15 multiple choice questions, and two open ended questions which tested the student's knowledge of basic biomechanical concepts, as well as their knowledge of helmet safety.

The second instrument was the Student Helmet Questionnaire (Appendix 3). This 4-point Likert scale questionnaire was used to assess the student's present helmet use, their intended helmet use, attitudes towards helmet use, reasoning for wearing a helmet, and demographic information. This tool was developed based on a previous study by Takriti, Lee and Mann (2001). Six Grade 7 teachers were once again asked to review the questionnaire to ensure it was at an appropriate level for the students. The questionnaire was revised after the feedback was received from the teachers.

The third instrument was the Satisfaction Questionnaire. Two versions of this questionnaire were developed, a Teacher Satisfaction Questionnaire (Appendix 4), and a Student Satisfaction Questionnaire (Appendix 5). These questionnaires were used to evaluate the students' and teachers' opinion of the Wizards of Motion program in areas such as: the use of technology, overall satisfaction of the program, the amount and type of support the teachers received, and the value of the educational practices used by the delivery team. The Student Satisfaction Questionnaire consisted of a 4-point rating scale with questions dealing with all the above mentioned areas. A 4-point scale was chosen to force the students to make a decision, therefore not allowing the students to choose neutral for every question. The last two questions allowed the students the opportunity to list the things they liked about the program and things they would change about the program. The Teacher Satisfaction Questionnaire consisted of a series of yes/no questions along with an invitation to provide additional comments. The teachers were also given the opportunity to explain what they liked and what they would change about the program.

The fourth instrument was the Delivery Team's Presentation Log (Appendix 6). The three program implementers completed a group journal after each of the program delivery experiences. To help guide their responses a form with prompting questions was provided.

Data Collection

A matching quasi experimental research design was selected for the section of this study dealing with the Knowledge Based Test, and the Student Helmet Questionnaire. This study consisted of two classrooms that received the Wizards of Motion Helmet Intervention, and three classrooms that did not (See Table 2).

Table 2. Quasi-Experimental Design

Grouping	Pre-test	Intervention	Post-test
Intervention	X1	O	X2
Non-Intervention	X3		X4

The intervention group was given the Knowledge Based Test and the Helmet Questionnaire approximately one week prior to the program. The Wizards of Motion team then visited the designated classrooms, during which time the students completed the discussions, activities and data collection as describe previously. Two days later the students were, once again, required to complete the Knowledge Based Test and Helmet Questionnaire. At the end of the Wizards of Motion – Helmet Safety Module presentation, the students and teachers were required to complete the Student/Teacher Satisfaction Questionnaire. Also, the Delivery Team completed a presentation log which described the day's events.

The control group was also required to complete the Knowledge Based Test and the Helmet Questionnaire. In order to increase the reliability of the dependent measures, the control group and intervention group completed the tests during the same 2 week span. After a time lapse of approximately one week, during which they continued on with their regular science curriculum, the students were required to complete the Knowledge Based Test and Student Helmet Questionnaire again.

To protect confidentiality of all the participants the tests were coded in a three digit number. The first digit referred to the time of the test. A "1" indicated it was a pretest, while a "2" indicated it was a post-test. The following two digit number was the student number. After each test (pre and post) was distributed to the participants, the teacher wrote the three digit number down on a class list. At the end of the testing each student had a pre-test number, and a post-test number. The teacher removed names from this list, and then provided it to the researcher.

Statistical Analysis

General demographic information. The demographic questions asked at the beginning of the pre-test were analyzed using descriptive statistics and frequencies.

Knowledge based test. The scores from the knowledge based test were analyzed by using a 2(group) x 2(time) mixed factorial ANOVA with repeated measures on the last factor.

Student helmet questionnaire. The Student Helmet Questionnaire required students to do five things: i) rate statements about bicycle helmets, ii) rate statements regarding why they do or do not wear a bike helmet, iii) rate their future helmet use, iv) list reasons why people wear helmets, and v) list reasons why people do not wear helmets. Although parts i, ii, iii of the attitude questionnaire consisted of Likert scale data, a study by Baggerly and Hull (1983) indicates that parametric statistics can be used on 4-point or greater Likert scales. Therefore a pairwise t-test was used for sections i, ii and iii. A probability level of 0.05 was used. The student's responses for parts iv and v were categorized into themes and the response percentages for each theme were calculated.

Satisfaction questionnaire. The frequencies of responses for the Student Satisfaction Questionnaire were analyzed using a goodness of fit test. The responses were based on a 4-point Likert scale with a x^2 critical value of 7.81.

The questions were then categorized into themes: i) value added by the program, ii) opportunity for active learning, iii) feedback they received from the delivery team, iv) interaction between students and delivery team, v) collaboration with peers, and vi) technology. The scores for each theme were summed and a satisfaction percentage calculated.

The qualitative responses from both the students and teachers were categorized separately into themes and were used to help support or contradict the findings.

Delivery team log. The results from the delivery log were used as qualitative information to help support or contradict the findings.

Results

The results of this study were based on the information collected from four instruments: i) Knowledge Based test; ii) Helmet Attitudes Survey; iii) Student and Teacher Satisfaction Survey; and iv) Delivery Team Log. The results are presented in five sections. The first section describes all of the students on variables such as: gender, age, bicycle use, helmet ownership and helmet use. The second section describes the control and intervention scores on the Knowledge Based Test. The third section describes the responses of the control and intervention groups on the Helmet Attitude Survey. The fourth section describes responses of the students and teachers, both qualitatively and quantitatively, on the Satisfaction Survey. Finally, the fifth section describes the delivery team's record of the presentations.

The data for the study were collected, organized and compiled into various spreadsheets, and analyzed using SPSS to determine the descriptive statistics for specific variables, along with the appropriate comparisons.

Student Demographic Information

Data for this study is based on responses from five schools. Of these five schools, two participated in the intervention group, while the remaining three participated in the control group. In total, 74 (*n*male = 35, *n*female = 39) students took part in this study; 37 (*n*male = 17, *n*female = 20) students were in the control group, and 37 (*n*male = 18, *n*female = 19) were in the intervention group. As part of the pre-test for the Knowledge Based Test, students were required to answer a series of demographic type questions relating to bicycle use, helmet ownership, helmet use and parental helmet use. Age was found to be extremely homogenous (M=12.30, SD=0.49), and therefore will not be discussed any further.

Bicycle use/reasoning. The participants were asked how often, if ever, they ride their bike. The results shown in Figure 3 indicate that the majority of students (38%) ride their bikes "most days". The results also show that males (31%) ride their bike on a daily basis more often than females (10%).

A follow up question to "how often" the students ride, was the student's reason for riding a bicycle. The results shown in Figure 4 indicate that most students (67%) ride "for fun". The next highest reason (22%) was "to go see my friends".

Helmet ownership. When asked if they owned a helmet, 88% of students responded "yes", while 12% responded "no". When categorizing the responses by gender, the results indicate that 89% of males and 87% females own a helmet, while 11% of males and 13% of females do not (Figure 5).

Helmet use. Although it is the law that these participant's wear a helmet when riding a bicycle, it is interesting to note that only 32% (n=24) responded that they always wear their helmet. Of these 24 participants, 15 were female and 9 were male (Figure 6).

Parent's helmet use. Lastly, students were asked "how often do your parents wear a helmet when riding a bicycle". According to their child, of the parents that ride a bicycle (n=51) only 20% "always" wear a helmet, while 33% of parents never wear a helmet when riding their bike (Figure 7).

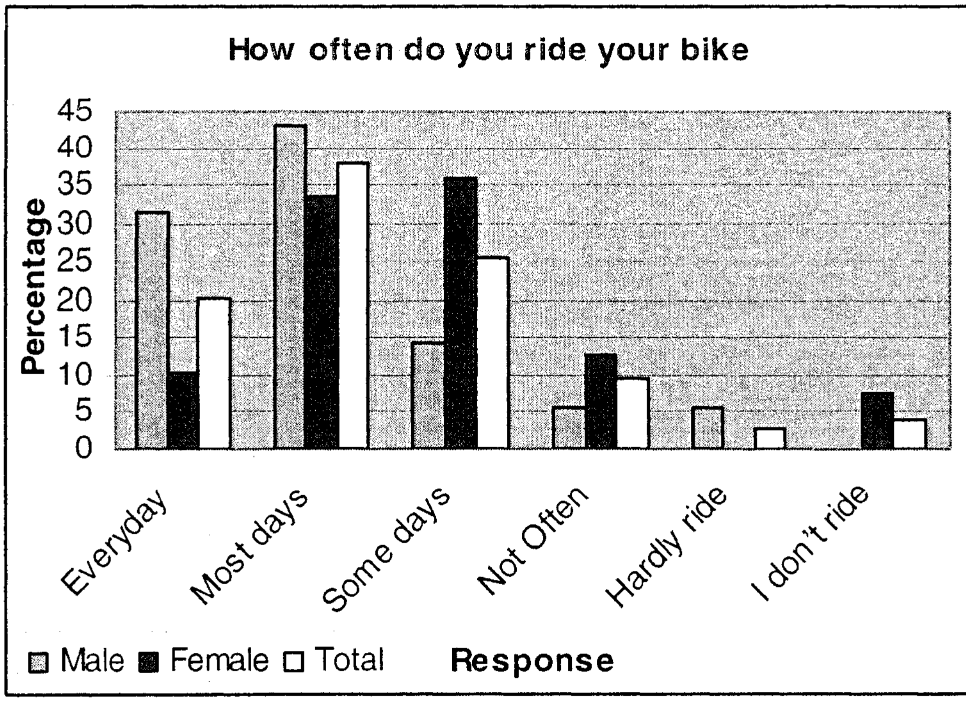

Figure 3. Frequency Distribution - How often participant's ride a bike

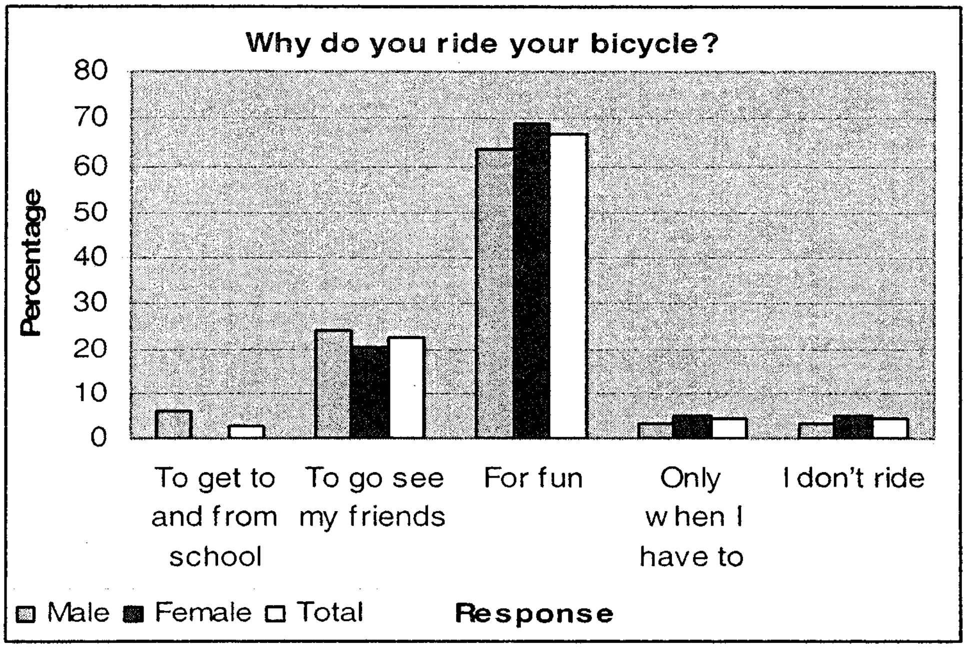

Figure 4. Frequency Distribution - Reasons for riding a bike

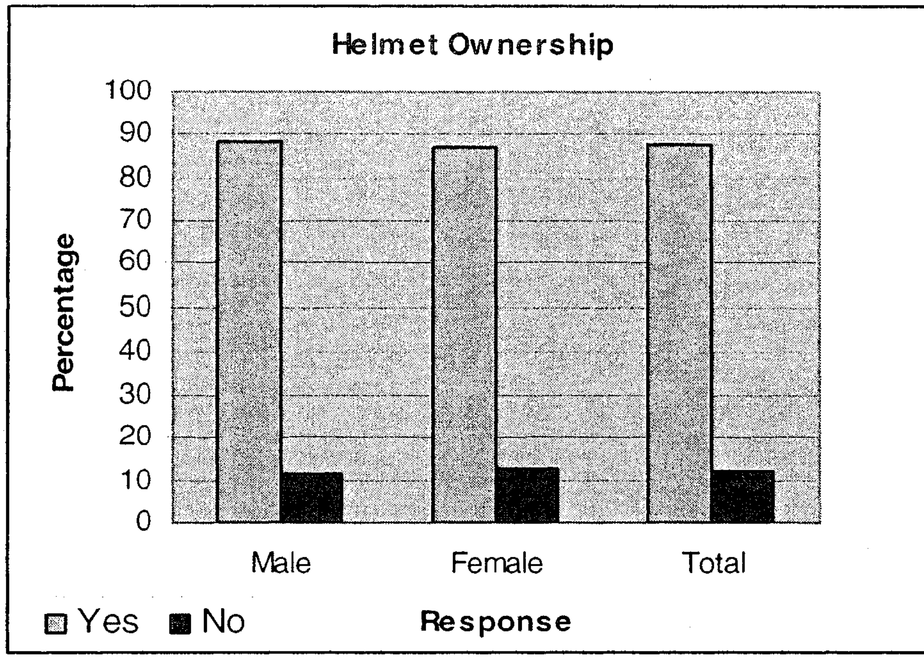

Figure 5. Frequency Distribution - Helmet Ownership

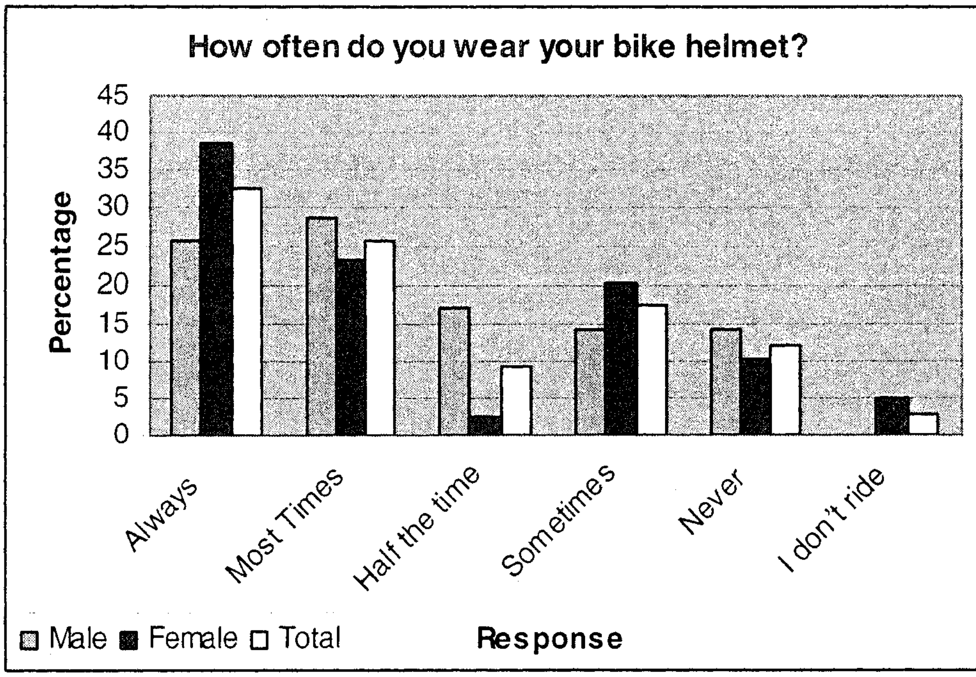

Figure 6. Frequency Distribution - Bike Helmet Use

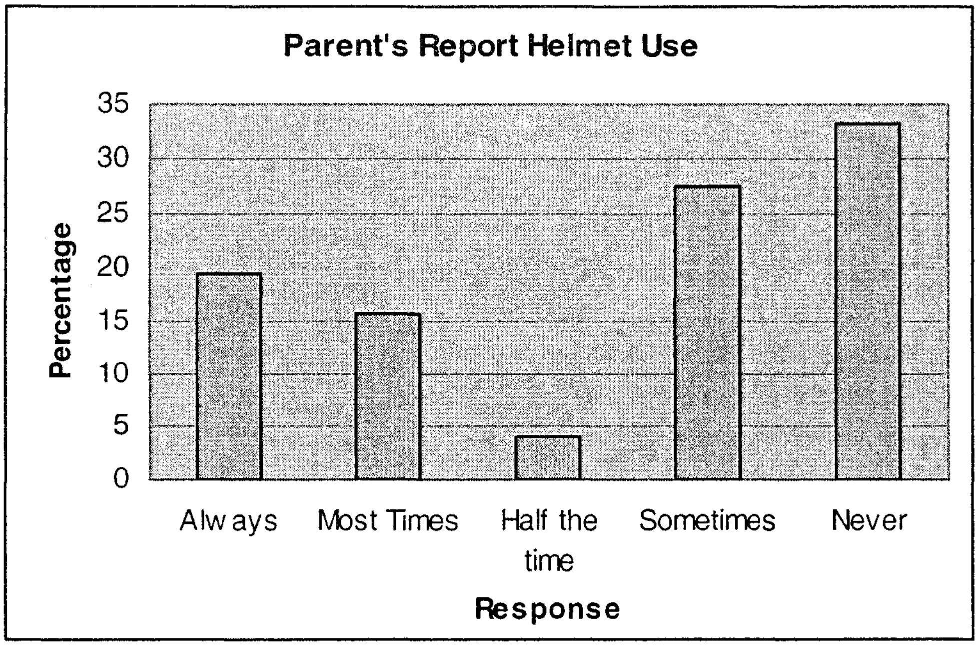

Figure 7. Frequency Distribution - Parent's helmet use

Knowledge Based Test

Cronbach's Alpha was used to determine the internal consistency of the questionnaire. Alpha values computed for the pre-intervention and post-intervention were 0.56 and 0.74, respectively. A commonly accepted demarcation point for the Cronbach's Alpha is 0.70 indicating a level of internal consistency among all items toward a single uni-dimensional factor. While the post intervention value of 0.74 met the criteria, the pre-intervention value of 0.56 indicates that there is a generally high level of variability in the data set prior to the implementation of the Wizards program. Further research on the measurement characteristics of the questionnaire is warranted.

The analysis of variance was used to determine if the students' overall knowledge of biomechanics and of helmet safety changed significantly. More specifically the analysis was a 2(group) x 2(time) mixed factorial ANOVA with repeated measures on the time factor. The results of this analysis indicate that there was a significant difference between the pre versus post test scores ($F = 8.24$; $df = 1$; $p < 0.05$), but no significant difference was found between the control and intervention groups ($F = 0.16$; $df = 1$; $p > 0.05$). A significant interaction effect was found within the overall model ($F = 4.26$; $df = 1$; $p < 0.05$) and is presented in the ANOVA Summary Table, below.

Table 3. ANOVA Summary Table

Source	Mean Square	F	*p*
Main Effect: Time	87.81	8.24	0.01
Main Effect: Group	1.73	0.16	0.69
Interaction Effect: Time*Group	45.43	4.26	0.04
Cronbach's Alpha (post-test)	0.74		

A Newman-Keuls' multiple range post hoc comparison test was used to determine exactly which means within the interaction effect were significantly different. The data for the means comparison used the group x time means of the interaction as illustrated in Figure 8. The results of the Newman-Keuls' post hoc test suggest that only the difference between the intervention group pre-test versus post-test means were significant ($t_{obs} = 2.65 > t_{critical} = 1.82; p < 0.05$).

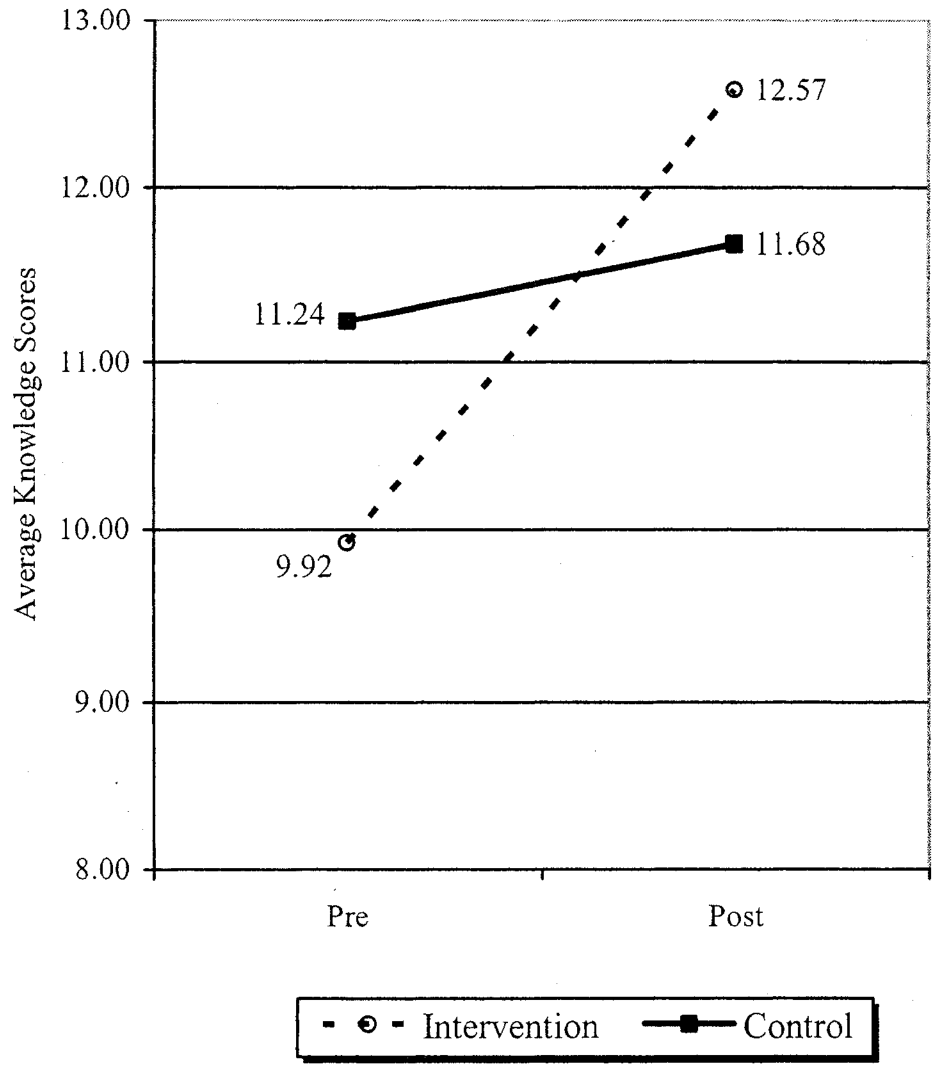

Figure 8. Average Score on Knowledge Based Test: Pre to Post Comparisons for Intervention versus Control Group

Helmet Attitude

A pairwise t-test was used to determine if there was a significant change in attitudes from pre-test to post-test, for each group independently in regards to their rating of statements dealing with helmet use. Students were asked to rate their agreement (agree, disagree) for each of the statements. The results indicate that only one of the 11 statements showed a significant change in attitude. The intervention group showed a significant decrease in agreement for the statement "I feel tough wearing a helmet" (t=-2.25; df=36; p<0.05).

A second pairwise t-test was used to analyze the student's rating of why they do or don't wear a helmet. The results indicate that only one of the seven statements was determined to be significant. The statement, "What your friends think and say" (t = -2.04; df = 36; p < 0.05), became significantly more important to the intervention group following delivery of the program.

The Helmet Attitude Questionnaire requested that the students rate their predicted helmet use. The results shown in Table 4 indicate that there was a significant increase in predicted helmet use from pre-test to post-test (t = 2.82; df=31; p<0.05) for the intervention group. The control group did not show a significant change in predicted helmet use from pre-test to post-test.

Table 4. Predicted Future Helmet Use - Pairwise t-test

	Difference Mean +/- Std. deviation	Pairwise t-test	2 tailed significance
Control	-0.17 +/- 0.71	-1.44	0.16
Intervention	0.38 +/- 0.75	2.82	0.01

The Helmet Attitude Questionnaire required the students to provide two reasons why people wear a helmet and two reasons why they do not. The student's answers were then categorized into themes and the frequency of each theme was calculated.

When the students answered "why people chose not to wear a helmet", 13 different themes were found; Fit, Look, Peer Pressure, Effects Riding, Don't need to, Cost, Don't have one, Parents don't, Need a new one, Cool factor, Time, Forget, Just don't (Figures 9 & 10). In both the control and intervention groups, the "cool factor", or it just is not cool to wear one, was sited as the greatest reason not to wear a helmet. Other issues that were sited frequently were, fit, look, peer pressure and don't need to.

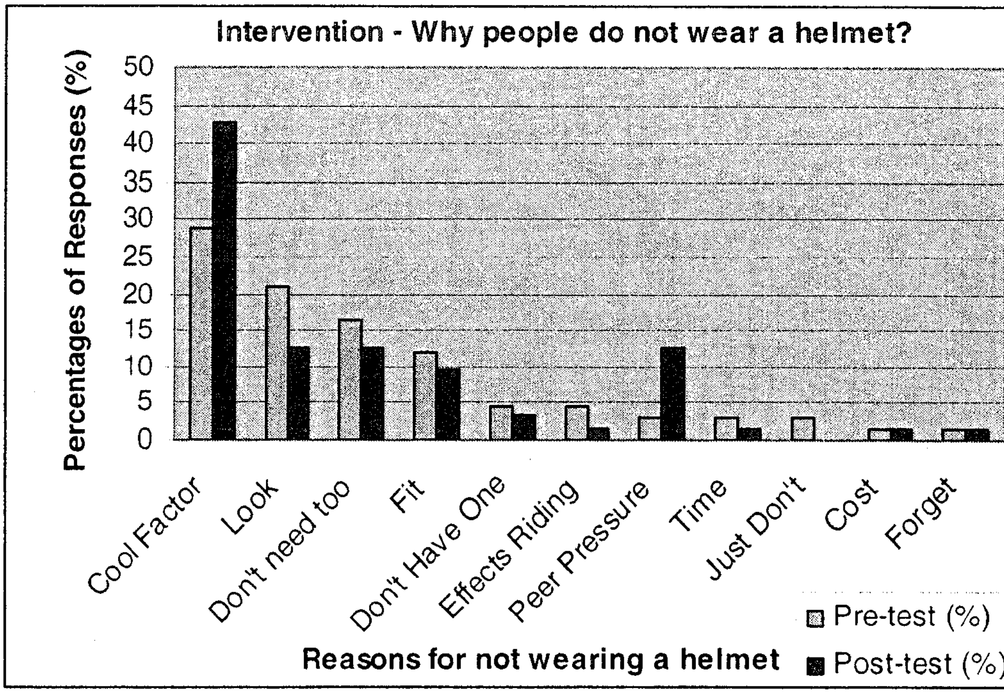

Figure 9. Frequency Distribution – Intervention Group – Why people do not wear a helmet

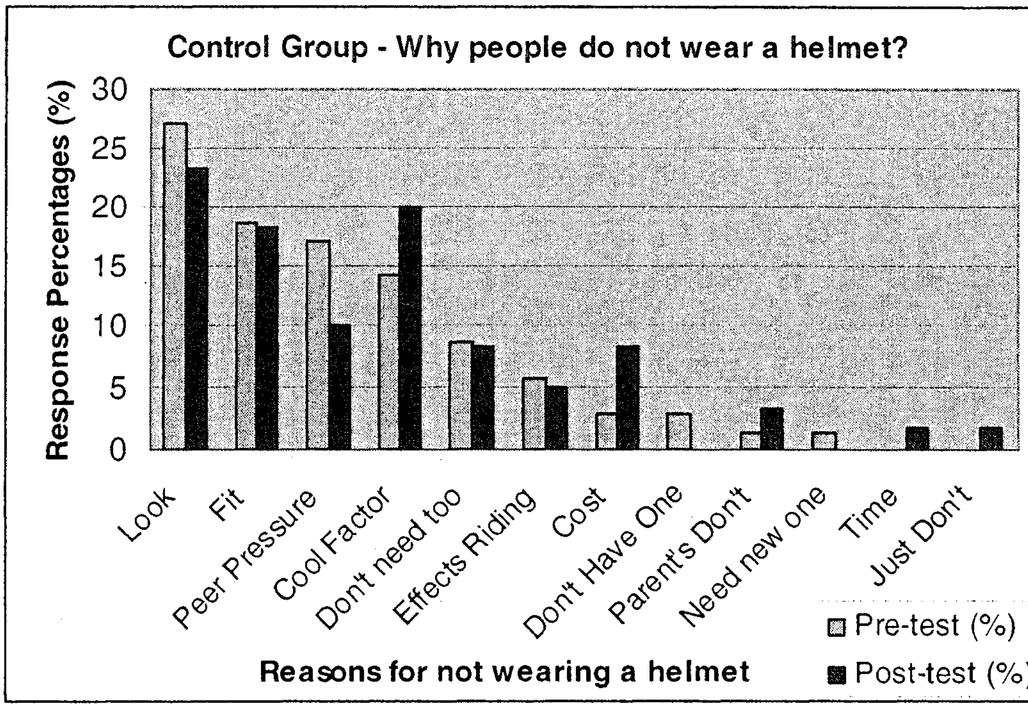

Figure 10. Frequency Distribution - Control Group – Why people do not wear a helmet

When asked why people wear their helmets, five themes were determined: Safety, Effects Riding Law, Role Model and Parents. Within the intervention group, the frequency of the "safety" theme increased from 25.49% in the pre-test to 67.86% in the post-test (Figure 11), while the control group demonstrated minimal changes in reasoning (Figure 12).

Program Satisfaction

Student satisfaction. At the end of the program delivery, students in the intervention group were asked to complete a questionnaire about their perceived satisfaction with the program. Specifically they were asked about the value added by the program, their opportunity for active learning, the feedback they received from the delivery team, the interaction between students and delivery team, collaboration with peers, and the technology. The results of this questionnaire were analyzed using a goodness of fit test. All of the goodness of fit test results suggested that the distribution of the scores were not distributed across the responses equally (Appendix 7).

Due to the construction of the Student Satisfaction questionnaire, there are both negative and positive polarity questions. Four questions were negative in polarity, while the remaining questions were positive in polarity.

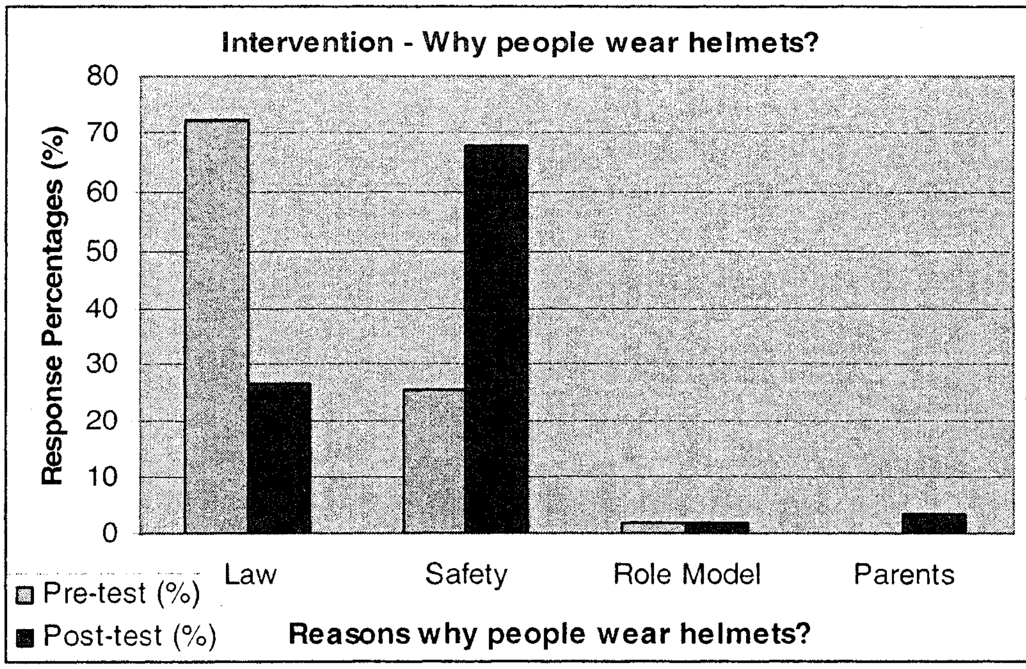

Figure 11. Frequency Distribution – Intervention Group - Why people wear a helmet

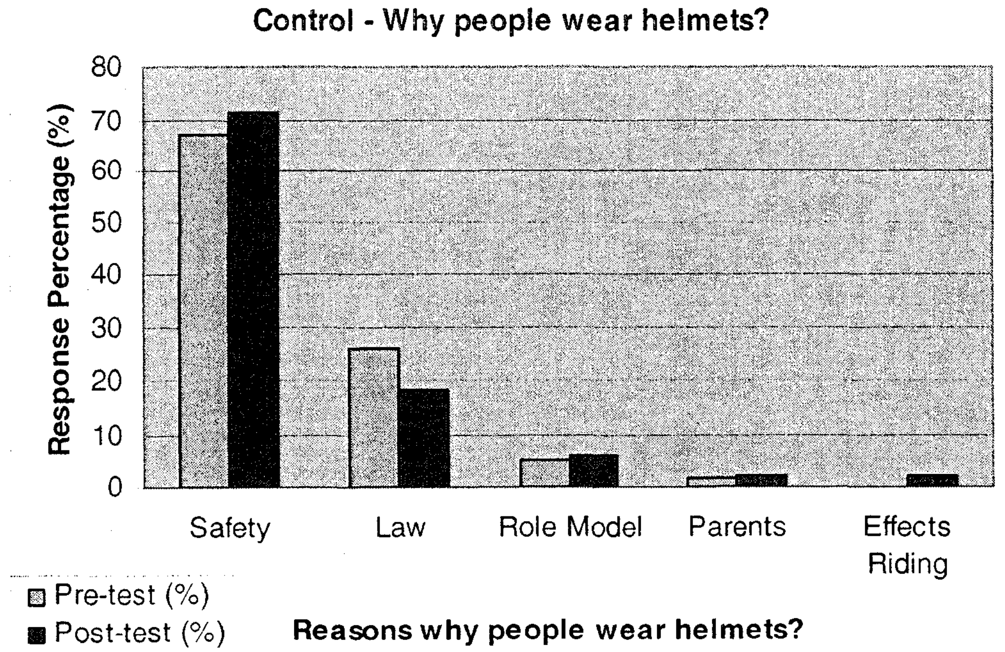

Figure 12. Frequency Distribution - Control Group – Why people wear a helmet

For the positive polarity questions (n=15), the frequency of responses was greatest for the "strongly agree" and "agree" responses if the students were satisfied with the program. The majority of the questions were found to elicit a satisfactory response by the students. The responses for question three, which asked students to comment on having lots of time to interact with other people in the class, were clumped at the "disagree" and "strongly disagree" end. The responses for question 10, which referred to the student's feeling of involvement in the program, were split between the "agree" and "disagree" responses.

For the negative polarity (n=4) questions the frequency of responses for the "disagree" and "strongly disagree" was greatest if the student felt satisfied with the program. While the respondents generally felt satisfied with the program, there were two questions which stood out as being inconsistent with the results of the overall survey. Question six, which referred to the student's interaction in the program, and question 15 which referred to the student's opportunity to interact with peers, elicited less favorable responses from the students.

Question 20 on the Student Satisfaction Survey asked the students if they would like the Wizards of Motion team to return for another visit. The results of the frequency graph indicate that a majority, 92%, of the students (n=35) would like the Wizards Team to return.

Themes. The questions were then categorized into themes: i) value added by the program, ii) opportunity for active learning, iii) feedback they received from the delivery team, iv) interaction between students and delivery team, v) collaboration with peers, and vi) technology.

The values were summed to get a total score for each distinct question and an overall score for each theme. These results are shown in Table 5. The lower the score the less satisfied the students were with that theme. A satisfaction score of between 0% - 50% designates unsatisfactory, while a score of 50% -100% designated satisfactory response.

Table 5. Satisfaction Results – Percentages based on Themes

Theme/Category (Cronbach's alpha = 0.74)	Included Questions	Overall Score	Overall Percentage
Technology	16, 17, 19	398/464	85.78%
Value Added	1, 2, 5, 7, 8, 9	750/932	80.47%
Feedback from Wizards Team	11, 12	242/304	79.61%
Student-Delivery Team Interaction	4, 13, 14, 18	493/620	79.52%
Active Learning	6, 10	208/308	67.53%
Collaboration with Peers	3, 15	168/308	54.55%

Results from the above table indicated that the Technology theme and the Value Added themes were the areas with which the students felt most satisfied. On the other end of the spectrum, Active Learning and Collaboration with Peers were areas in which the respondents felt a lower level of satisfaction.

Student qualitative feedback. Students were asked to comment in their own words on what they liked about the program and what they would change about the program. These comments were recorded and categorized into themes.

The themes that arose out of the student's responses to what they "liked" about the program included: the overall program, the slideshow, the experiments and the delivery team. Students felt that overall the program was fun and exciting, and they really enjoyed learning about the science of helmet safety. Students really enjoyed the video and graphic components of the slideshow. The head drop and egg experiment were well received by the students. Lastly, students made positive comments about the delivery team. They felt the team members were friendly and easy to interact with, and explained the content well to the class.

The themes that arose from the student's responses to what they would change about the program included two themes: involvement and the presentations. Within the presentation theme, students felt the presentation was too long, and wished there was less talking. They indicated that they wanted to see more videos, and have more examples shown to them. The majority of the comments focused on involvement. Students indicated they loved the different experiments and/or they wanted more hands on activities. They also suggested that more group work may have enhanced the interaction.

Teacher qualitative feedback. The teachers were given a feedback form after the completion of the Wizards of Motion program. They were asked a series of Yes/No questions. Under each question they were given space to provide any written support for their answer. Due to the limited sample size (n=2), the results will only be presented as qualitative results. The questions can be categorized into the following themes: educational practices, teacher support/workshop, technology and the overall program.

The educational practice theme consisted of questions dealing with active learning, feedback to students, student-delivery team interaction, collaboration between peers, and links to the Ontario Curriculum. Overall the teachers felt positive about all areas. The two teachers did suggest that the Wizards Team should consider even more opportunities for hands on opportunities for the students as this component was a real highlight of the program. One of the teachers felt that more opportunity for collaboration between students could have been added, although he did not see this as a problem.

The questions related to teacher support and the teacher workshop addressed the value of the information provided prior to the team's visit, the value of the teacher workshop, support received from the school board, principal and the Wizards team. Of the two teachers, only one was able to attend the workshop due to a previous out of town commitment. The information provided was found to be beneficial to the teacher and to the success of the program. Both teachers reported that they received appropriate support from their school board and principal.

The third theme included questions related to the teacher's satisfaction with the technology brought into the classroom. Both teachers felt that the Wizards of Motions use of technology added value to their classrooms and to their student's learning experience.

The last theme included questions related to the teacher's appreciation for the program as a whole, areas that they liked, and areas in which they suggested some improvements. The responses from the teachers indicated that they felt the program as a whole was a positive experience for the students. One teacher discussed the authentic learning opportunity that the program provided, "I enjoyed the program, adding reality to why the students take science. They needed to see why science is learned in school." The second teacher felt the program provided an opportunity for students be "introduced to a program (Kinesiology) which could lead to variety of career choices." Also he felt "students were able to visualize the importance of wearing a helmet" as they "actually saw and heard the helmet reduce the force of impact."

Delivery team. At the end of each session, the delivery team was asked to complete a log of the day's events. This was done to track any issues or changes that occurred during the delivery. According to the log book, both presentations were delivered as the team planned. The Wizards Team noted the importance of maintaining a safe learning environment by allowing just one student up at a time to experiment with the equipment. The Wizards Team ensured that every child who raised their hand to volunteer for the six interactive activities each had at least one chance to participate.

Discussion

The purpose of this study was to evaluate the implementation and utilization of the Wizards of Motion Helmet Intervention module. Patton's second phase of the Utilization-Focused Evaluation flowchart required collaboration between the evaluator and the stakeholders to determine the scope and questions the evaluation would address. After a series of meeting with stakeholders, a content framework for evaluating the Wizards of Motion – Helmet Intervention module was created. The framework was based on previous models developed to address outcomes and practices in web-based delivery programs (Billings, 2000, McPherson & Montelpare, 2004). The development of this framework guided both the delivery and the evaluation of this program. The focus of an Utilization-Focused Evaluation is on creating an evaluation which would be used by the stakeholders therefore, the involvement of the stakeholders during the development of the research questions helped to ensure the components of the program that are important to the stakeholders are evaluated. The following categories were identified by the stakeholders and evaluators as important: use of portable lab equipment, delivery team support, educational practices, teacher support, and learner outcomes. These five categories were then used to develop the eight research questions the evaluation addressed. The eight research questions were grouped into three themes: Program Implementation, Program Outcomes and Value Added.

Theme 1 - Program Implementation

The Program Implementation research questions were used to determine if the curriculum was implemented without problems or concerns. The "implementation" theme included questions regarding the support received by the teachers from both the Board of Education, and from the delivery team. This theme also included questions regarding the physical environment the delivery team presented in, and the educational practices used during the delivery.

The educational practices incorporated into Wizards of Motion program included active learning with technology, student- delivery team interaction, peer interaction and appropriate links to the Ontario Curriculum documents.

An analysis of the results from the delivery team log suggests that the program was implemented as it had been intended to. Each session was scheduled with the teachers with an appropriate lead time to allow both the teachers and delivery team to prepare. The teachers were able to arrange for the necessary delivery time to allow for the arrival and setup of the team along with the introductory PowerPoint and the head drop experiment. No technology issues arose and the equipment worked as desired. The Wizard's of Motion curriculum along with the associated tasks and activities were delivered as intended.

Question #1: Did the teachers report that there was adequate support provided from both the delivery team and the Lakehead Board of Educations to successfully complete the Wizards of Motion Helmet Intervention module.

The qualitative results from the Teacher Satisfaction Survey indicate that the teachers felt they received the support necessary at both the school and school board level. Both of the teachers described the interaction with, and the support received from, the delivery team prior to the program implementation as a positive.

Question #2: Was there adequate time, space and technical support to allow for the complete delivery of the module?

The results from the delivery team log and the teacher's satisfaction survey suggest that the technical support, time and space provided allowed the program to be delivered without any interruptions. Any technical issues that arose were easily fixed by the technical staff on the delivery team. In regards to space the teachers were able to easily arrange the appropriate space needed. In some cases this meant using the library or a larger classroom. The two hour time span needed to complete the program was achieved in all the schools. One teacher did suggest it was difficult to arrange a time during the school year for the Wizards team to visit. This teacher expressed concern with addressing all of the demands of curriculum expectations for Grade 7.

Question #3: Were the educational practices used incorporated into the Wizards of Motion Helmet Intervention module effectively?

Through out the delivery of the program, the Wizards Team used a variety of educational practices to enhance the delivery of the program. The educational practices that were important to the stakeholders included the student's active learning with technology, the student interaction with both their peers and the delivery team, feedback from the delivery team and the links to the Ontario Curriculum. According to the results of the goodness of fit test and the theme based analysis of the Student's Satisfaction Questionnaire and the Teacher's Satisfaction Questionnaire, most of the educational practices were very well received. Both students and their teachers indicated they would like to have more active learning opportunities with the technology, and opportunities for peer collaboration. While numerous comments were recorded on the Student Satisfaction Questionnaire that indicated that the students thought the technology was "cool", "exciting", and/or "fun", many of the comments recorded in the "areas to improve" section indicated a desire to be chosen to interact more with technology. The Wizards Team brought six different pieces/systems of technology in order to demonstrate and provide opportunities for student interaction. The Wizards Team maintained a safe learning environment by inviting just one or two volunteers to participate in each activity at a time. The team ensured that every child that raised their hand to volunteer had at least one opportunity to interact with the technology. The class was also involved in providing verbal feedback to the subjects working with the Load Cell Force System, participating in the egg toss experiment, and reading and recording the data from the Head Measurement System. All students were involved in the final helmet data analysis activity.

The other suggestion from the students and teachers was to allow for more collaboration between the students. Perhaps the curriculum could be refined to include one activity that would enable the students to explore a piece of technology in small groups.

Theme 2 - Program Outcomes

The "Program Outcomes" theme incorporated all the research questions that dealt with the measurement of the changes in knowledge, helmet use, and helmet attitudes. According to Scriven (1986), these are the questions that an evaluation should be concerned with. He believes it is the worth of the program, whether it's good or bad, that an evaluator should comment on. Since this evaluation follows the framework of Patton's Utilization Focused Evaluation (1986), Program Outcomes is only one portion of the total evaluation of this program.

According to Kirkpatrick's 1998 book, Evaluating Training Programs: The Four Levels, the *Program Outcomes* described in this evaluation fall within the second and third levels of Kirkpatrick's evaluation theory. The second level, also know as "learning", evaluates the participant's change in knowledge. In this study, the change in knowledge refers to a change in biomechanical and head safety knowledge. The third level, "transfer", evaluates the participant's change in behavior. Due to the limited scope of this study, a behaviour change could not be measured, therefore the student's intended helmet use was used in place of the behaviour change.

Question #4: Did the participants in the program show a significant increase in knowledge of basic biomechanical terms and concepts, determinants of head injury and safe head practices in comparison to the non-program participants?

The knowledge based test was administered to evaluate any changes in knowledge in the areas of biomechanics and helmet safety. The results of the pre-test indicated that there was a significant difference in their level of knowledge. In the context of this study, the control group started with a higher knowledge base of biomechanics and helmet safety, than the intervention group. Although the control group started higher, the mean score on the test was only at approximately 50%. This suggests that there was still plenty of room for improvement.

The results from the Knowledge Based Test indicate that the intervention group showed an increase in knowledge in biomechanics and head safety knowledge while the control group did not. These results suggest that the Wizards of Motion program had a positive effect on the knowledge base of the students that received the program in biomechanics and helmet safety.

Question #5: Did the students show a change in their attitudes related to helmet use?

The second outcome measure evaluated was the change in helmet safety attitudes. The results from the attitude survey did not show any changes in attitudes, suggesting that the program had no effect on the attitudes of the students. However, the pre-intervention frequency distribution graphs highlighted the existence of positive attitudes.

Interestingly, although this study showed very few significant attitude changes, a significant difference in predicted helmet use was found. Due to the scope of this study, it was impossible to record the student's actual future helmet use, so students were asked to predict their intended future helmet use on both the pre-test and the post-test. Results indicate that although students already have the desired attitudes towards helmet use, they are not always wearing their helmets. According to ThinkFirst, only 55% of individuals between the ages of 11-14 reported that they always wore a helmet when cycling (ThinkFirst, 2005). In this study only 32% of the students reported that they always wear a helmet. After the students participated in the program, the intervention group showed a significant increase in their intended helmet use (M=0.38, SD=0.76). Although their attitudes did not change, their intended helmet use did.

Question #6: Did students show a change in the reasons that they expressed for why cyclists should wear a helmet?

According to the students the major deterrent to wearing a helmet is the "cool factor" and the "look". Children do not want to do anything that isn't considered cool. This question is extremely important to the future development of the program. The issues brought up by the students should be used to further enhance the program by addressing the major deterrents to children wearing helmets. Further development of this program should include discussion about the need to be "cool" versus the need to be safe, and perhaps allowing time for discussion with the students on how to make helmets cool.

Students were asked to give reasons why people should wear helmets. It is noteworthy to discuss the increase in safety consciousness demonstrated by the intervention group. One goal of the stakeholders was to have the students show an increase in the internal reasons for wearing a helmet, opposed to the external reasoning.

External reasons are those that some one else imposes on them, while internal reasons are those that the students choose themselves. The majority of reasons given by the intervention group before the program dealt with reasons that were external to themselves, such as it's the law, or mom and dad make me. After the program the majority of the reasons became internal to the students, such as it protects me. Students were suggesting that safety was the greatest reason to wear a helmet. Similar changes in reasoning were not present in the control group, however within the control group the idea of safety was cited as the most frequent reason for wearing a helmet.

Theme 3 - Value Added

The Value Added research questions included questions to both the students and the teachers regarding the overall worth of the program. The stakeholders wished to know if the teacher and students felt the use of a portable lab technology and the overall Wizards of Motion program added value to their science class. This level links to Kirkpatrick's (1998) first level of evaluation, reaction. This level describes what the participants liked and disliked about the program.

The 1987 paper by Ivany, Sherwood, and Widen, suggested that there was a need to link curriculum to student's everyday life. The Wizards of Motion program used the idea of head safety to bring technology and science concepts to life for the students. According to the results of the Value Added questions both students and teachers alike recognized the value in the program.

Question #7: Did the students and teachers feel the portable lab technology added value to the Wizards of Motion Helmet Intervention module, and ultimately to their science class?

Overall the goodness of fit and the theme data generated from the questions asked in the Teacher Satisfaction Survey and the Student Satisfaction Survey supports the notion that the students felt positive about the use of technology in the classroom and ultimately the Wizards of Motion program. The technology theme generated from the Student Satisfaction Questionnaire scored the highest of the theme data, suggesting that is was the area the students were most satisfied with. The technology theme scored an 87%. The qualitative data supports this finding, suggesting students really enjoyed the "experiments" or the "head drop" presented in the program.

Question #8: Did the students and teachers feel the Wizards of Motion - Helmet Intervention program added value to their science curriculum?

Overall the students and teachers both felt positive about the whole experience. When the students were asked to describe what they liked about the program the themes that came up were the delivery team, the experiments, the slide show. Students indicated that they enjoyed their interaction with the delivery team. Responses indicated that the students felt comfortable with the delivery team and were not intimidated by them. Both of the teachers suggested that the technology, pre-reading, and educational practices were greatly appreciated. The greatest compliment to the program was when students were asked if they would like the Wizards of Motion to come back again, and 92% of the students said yes. Although there were many positive things about the program, students and teachers did mention areas they would like to see even more opportunities for interaction, and peer collaboration.

Benefits of the Program to Head Safety and Injury Prevention Education

The "Wizards of Motion" head injury prevention module provided a unique opportunity for students to visualize the outcomes of unsafe practices while studying specific concepts within the Grade 7 Ontario Science Curriculum. Using a novel approach that combined the demonstration of injury outcomes with basic principles of biomechanics and physics, instructors were able to teach about, rather than preach about, the consequence of non-compliance to safe head practices.

The emphasis of this program was placed on bicycle helmet use, as it is legislated by the Ontario government that all children under the age of 18 must wear a helmet. In surveying the participants of the study, the results indicated that 84% of the students ride a bike on a daily basis. The finding from this study is higher than the National Population Health data (1994-1995) finding that 68% of children under the age of 18 ride a bicycle (Pless & Millar, 2000). Even though provincial legislation exists in Ontario mandates all people under the age of 18 to wear a helmet, only 58% of these children always wear their bike helmet (Pless & Millar, 2000). The results from this study indicated that while approximately 88% of the students owned a helmet, only about 32% of them reported "always" wearing it. A study completed in 1995, by Parkin et al. in which children were provided helmets as part of an intervention delivered across different geographic areas, the authors found that even though the intervention group's helmet ownership increased from 10% to 47%, helmet use in the intervention group was no different than the helmet use in the control group. These results suggest that ownership alone is not a strong predictor of helmet use. The researcher in the current study believes that providing education to encourage children to adopt helmet wearing behaviours is paramount to increasing helmet use.

Although riding a bicycle is an activity most children participate in, there has been an increase in popularity of other muscular power activities such as skateboarding, roller skating, and riding a scooter. This popularity increase has prompted the government to entertain the idea of mandating the use of helmets for all people, regardless of age, when using all muscularly powered vehicles. In order to extend the impact of the safety message, the delivery team may wish to consider putting more emphasis on the use of helmets for other muscularly power sports, not just bicycling.

The results from the program outcome section of this evaluation suggest there was a significant increase in intended future helmet use along with a significant increase in head safety knowledge for the intervention group. This supports the research of Leblanc, Beattie and Culligan (2002) that suggests there is need to supplement the provincial legislation with educational programs.

The success in delivering the "Wizards of Motion" program illustrates the versatility of linking real time health promotion to standardized curriculum, and invites considerations for additional program links across the curriculum.

Summary & Recommendations

Summary

Overall the results of this study suggest that the Wizards of Motion was a positive experience for both the teachers and students involved. Teachers and the delivery team reported receiving support from the school board and the delivery team, along with the necessary time, space and technical support required to make the program successful. Most of the educational practices used were effectively incorporated into the program. Students would like to have more opportunity to interact with their peers and with the equipment. Students showed an increase in knowledge of biomechanics and head safety information. Although students did not show a change in attitudes towards bike helmets, they did express an increase in their intention to wear a helmet in the future and a change in the reasons they provided for wearing a helmet. Overall the teachers and students were extremely satisfied with the program, especially the technology aspect. The results also suggest that although it is the law that children under the age of 18 must wear a helmet while riding their bike, this is not happening. There is clearly a need for head safety programs such as Wizards of Motion to exist and to educate children and parents on the need for wearing helmets.

Program Recommendations

The following is a list of recommendations based on the findings of this thesis, to enhance and improve the Wizards of Motion program:

- Consider revisions to the curriculum to include one activity that would enable students to explore a piece of technology in small groups.

- Continue to introduce teachers and students to the technology in a safe and controlled learning environment.
- Address and incorporate the student's reasons for not wearing a helmet, such as the cool factor, looks and peer pressure, into the program.
- Continue to provide an opportunity for teachers to participate in a Teacher Workshop or some form of curriculum introduction prior to the program visit.
- Expand the discussion from bicycle helmets to other muscular powered vehicles (skateboards, roller skates).
- Continue to provide visual examples to the students during the power point presentation.
- Provide parents with information regarding helmet use.

Limitations to the Study

The following is a list of the limitations to this study:

- Schools that participate in the Wizards of Motion program did so by choice, and therefore may have an internal bias.
- Only two teachers participated, and therefore the teacher information was limited.
- The reliability and validity of the survey tools used to collect data.

Future Research Recommendations

Possible future research recommendations include:

- A longitudinal study on of the Wizards of Motion program, concentrating on helmet attitudes and actual helmet use.
- A study to establish the reliability and validity of each of the survey tools.
- Continued evaluations of the Wizards of Motion program to allow for continued growth of the program.
- An increased number of participants (greater "n") to allow for a multi-factor model to assess the internal consistency of the knowledge based test

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Appendix 1 - Information and Consent Form

Title: Wizards of Motion: An Evaluation of A Helmet Intervention Program

Dear Parents/Guardian of Potential Participant:

My name is Pamela Marsh and I am a graduate student at Lakehead University. Under the supervision of Dr. Moira McPherson, I am conducting a study on the evaluation the "Wizards of Motion" program.

The "Wizards of Motion" is an enriched science module for grade 7 students in Northern Ontario. A team of faculty and graduate students from Lakehead University will provide the direction for this module.

The purpose of this study is to evaluate the effectiveness of the program. We hope that by completing this program, students will 1) become more informed about the role of the helmet in many sports, 2) get hands on experience in running an experiment and, 3) introduce them to the area of human movement.

As a participant, the student will be asked to complete pre-program questionnaires regarding their knowledge, attitudes and beliefs about helmet safety. A week later the students will then take part in the "Wizards of Motion" module, after which they will be given the follow-up questionnaires.

All personal data will be kept strictly confidential and all information will be coded so that your child's name is not associated with his/her results. Only the named researchers will have access to the data.

There are no known harmful or potential risks to the participants involved in this study. In term of potential benefits that following have been identified:

- The students will be given the opportunity to participate in hands learning in the field of science.
- The students will be given the knowledge to make informed decisions regarding helmet usage.
- Ideally students will be turned on to the field of human kinetic and will hopefully consider it as a possible career choice.
- The development of an enriched science program which could be implemented provincially.

Your child's participation is voluntary and he/she may withdraw from the study at any time without any penalty. Student may choose to decline any question on the questionnaires. The principal investigators have emphasized to the entire team that any student not willing to participate, should not feel or experience any negative repercussions with respect to future participation with in their classroom. Therefore, no obligation is required for your child to answer any questions or to participate in any aspect of this project.

This study has been reviewed and approved by the Lakehead University Research Ethics Board, (File #), Office of Research, UC2003, (807) 343-8283. If you would like to receive more information about the study, review the questionnaires or the "Wizard's of Motion" program, please contact Pamela Marsh, at (807) 768-5160 or Dr. Moira McPherson at (807) 343- 8640.

Thanks for your assistance,

Pamela Marsh
Graduate Student
School of Kinesiology
Lakehead University
pkmarsh@lakeheadu.ca

Moira McPherson, Ph. D.,
Director and Associate Professor
School of Kinesiology,
Lakehead University
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Consent Form

Please ensure you and your child, have read and understand the following:

- I have read and understand the requirements of my child.
- I am aware of the benefits and potential risk associated with this study as outlined in the cover letter
- Each participant is a volunteer and can withdrawal from the study at any time
- Individual data will be kept confidential for each individual athlete. Publication of results will not reveal the participant's identity.
- The data will be securely stored for seven years at Lakehead University.
- By signing this consent you are giving your permission for your child to participate in the study "Wizards of Motion: An Evaluation of A Helmet Intervention Program".

CONSENT FORM

Child's Name: ______________________ School Name : ______________________

☐ I give permission for my child to participate in this study.

☐ I do **NOT** give permission for my child to participate in this study.

Signature of Parent/Guardian: ______________________ Date: ______________

Signature of Child: ______________________ Date: ______________

Appendix 2 - Knowledge Based Test

Please check the BOX that is the best answer for each question.

1. **KINESIOLOGY** is:
   The science of human movement.
   A material's ability to absorb force.
   A push or a pull.
   The science of how helmets work.

2. **BIOMECHANICS** is:
   The science of how helmets work.
   A material's ability to absorb force.
   A push or a pull.
   Forces and the how people move.

3. Within **KINESIOLOGY**, there are many jobs you can do. Name 3 that interest you.
   1)

   2)

   3)

4. **Force** is defined as:
   A person's ability not to move.
   A push or a pull.
   A person's ability to move.
   The shock absorption of a material.

5. **Impulse** is defined as:
   A push or a pull.
   Applying a force over a time.
   A person's desire not to move.
   The shock absorption of a material.

6. Which statement is **TRUE**.
   If you are under the age of 18, it is the law that you must wear a helmet when riding your bike.
   It is the law that everyone must wear a helmet when riding your bike.
   There are no laws about wearing helmets when riding your bike.
   You only have to wear your helmet when riding your bike if you are told to by an adult.

7. The _____________ absorbs the force as it goes through the helmet, so that less force gets to your brain.
   hard outer shell
   inside foam
   straps
   safety sticker

8. The __________ spreads the force over the helmet, so that it does not act in one spot.
   Hard outer shell
   Inside foam
   Straps
   Safety sticker

9. The __________ helps to hold the helmet tight to your head.
   Hard outer shell
   Inside foam
   Straps
   Safety sticker

10. Why **shouldn't** you put extra stickers on the outside of your helmets?
   It is OK to put stickers on the outside of your helmet. They don't have any effect.
   Stickers prevent the force from being absorbed. Therefore more force gets to your head, and you will get a bigger injury.
   Stickers prevent your head from sliding when you contact the ground. If your head can't slide this may cause greater injuries.
   It is illegal to add stickers other than safety sticker to your helmet.

11. Why are hockey helmets and bike helmets made differently?
   They aren't. They are made exactly the same way.
   They are two totally different sports. Each sport has different ways that the injuries can occur.
   They are made by different companies.
   Because hockey is a winter sport, and biking is a summer sport.

12. You need to get a new bike helmet after you have one big impact (hit).
   True False

13. Helmets in Canada are tested by which company?
   CSA (Canadian Standards Association)
   Lakehead University
   MTO (The Ministry of Transportation Office)
   Health Canada

14. If there is a safety sticker on your helmet, it means that:
   The helmet was tested and is safe to wear.
   The helmet is unsafe to wear.
   Nothing. There will never be a safety sticker on your helmet.
   The helmet is made by Lakehead University.

15. A hockey helmet can be used after multiple crashes (impacts) because:
   Hockey helmets have foam on the inside that will return to its normal shape after it has been impacted.
   It is too expensive to buy a new helmet after every impact.
   Hockey helmets have a really thin outer shell.
   Hockey helmets have foam on the inside that stays squished even after it has been impacted.

16. A **serious** injury is caused by:

A BIG fall that causes BIG forces.
A BIG fall that causes LITTLE forces.
A LITTLE fall that causes LITTLE forces.
A BIG fall that causes NO forces.

17. Name three kinds of forces.

1)

2)

3)

Appendix 3 - Student Helmet Questionnaire

Please check the BOX that is the best answer for each question.

1. What is your gender?

Male Female

2. What is your age?

11 12 13 14

3. Do you own a bicycle helmet?

Yes No

4. In the summer, how often do you ride your bicycle?

Every day
Most days (4 days a week or more)
Some days (3 days a week or less)
Not often (less than once a week)
Hardly ride (less than once a month)
Never ride a bicycle

5. Why do you ride your bicycle?

To get you to and from school
To go and see friends
For fun
Only when you have to

6. When you ride your bicycle, do you wear a helmet?

Always
Most times
Half the time
Sometimes
Never
I don't ride a bike

7. There is a law in Ontario that everyone (no matter how old) must wear a helmet when riding a bike?

Yes No

8. In the future, how often will you wear your bike helmet?

Always
Most times
Half the time
Sometimes
Never
I don't ride a bike

9. Please tick **ONE** box which shows your opinion of wearing a bicycle helmet
   - Makes you look good
   - Allows you to cycle faster
   - Makes you a safer cyclist
   - Helps protect your head only
   - Not worth wearing
   - Makes you look bad

10. Do your parents wear a helmet when they ride their bike?
   - Always
   - Most times
   - Half the time
   - Sometimes
   - Never
   - They don't ride bikes

11. Please place a check mark in the box which **BEST** describes how you feel.

	Yes, I agree	I kind of agree	I kind of disagree	No, I disagree
Helmets can prevent **minor** injuries when riding a bike.				
Only children should wear helmets.				
My parents believe wearing a bike helmet is important.				
Helmets can prevent **major** injuries when riding a bike.				
I feel safe wearing a helmet.				
Everyone should wear a helmet.				
I feel tough wearing a helmet.				
I feel silly wearing a helmet.				
I feel comfortable wearing a helmet.				
It feels unnecessary to wear a helmet.				
It is important to wear a helmet.				

Please place a check mark in the box which **BEST** describes how important the following reasons are to why you wear or don't wear a helmet?

	Not important at all	Not important	Important	Very Important
The way the helmet feels on your head.				
How the helmet looks.				
What your friends think and say.				
The cost of buying a helmet.				
If it was the law to wear a helmet.				
Whether your friends wear a helmet.				
If it was the school rule to wear a helmet.				

12. Please list 3 reasons why you think people choose **NOT** to wear helmets while participating in sports like bicycling, skateboarding, and inline skating.

    1.

    2.

13. Please list 3 reasons you think people **SHOULD** wear helmets while participating in sports like bicycling, skateboarding, and inline skating.

    1.

    2.

Appendix 4 - Teacher Satisfaction Survey

Please check the box which **BEST** describes your answer. Underneath each question is a section for you to elaborate on your decision for each question. If you choose "NO" please provide reasons why, and what we could do to improve for next time.

1. The Wizards of Motion program met my overall expectations.
   Yes No
   ___
   ___
   ___

1. I was satisfied with the content presented by the Wizards of Motion team.
   Yes No
   ___
   ___
   ___

2. I would invite the Wizards of Motion team into my classroom again.
   Yes No
   ___
   ___
   ___

3. The teacher workshop provided me with the necessary background knowledge about the technology.
   Yes No
   ___
   ___
   ___

4. The pre-program information provided by the Wizards of Motion team helped prepare me for the presentation.
   Yes No
   ___
   ___
   ___

5. The teacher workshop provided me with the background information needed to make the program successful.
   Yes No
   ___
   ___
   ___

6. I found it easy to schedule a visit date with the Wizards of Motion team.
   Yes No
   ___
   ___
   ___

7. I found it easy to arrange the appropriate space and time needed for the Wizards of Motion Program

Yes No

8. The School Board was supportive of the Wizards of Motion Program.

Yes No

9. I found it easy to arrange the time require for the Wizards of Motion program.

Yes No

10. My school was supportive of the Wizards of Motion program.

Yes No

11. The Wizards of Motion program had clear and relevant links to the Ontario grade 7 science curriculum.

Yes No

12. The program provided interactive learning for the students.

Yes No

13. The students were engaged through out the program.

Yes No

14. The delivery team provided appropriate feedback to the students.

Yes No

15. The delivery team interacted with the students in the appropriate manner.

Yes No

16. The student enjoyed the interaction with the delivery team.

Yes No

17. The program allowed the students to interact with their fellow students.

Yes No

18. I found it easy to get in contact with the Wizards of Motion team to answer any of my questions.

Yes No

19. The Wizards team was able to answer any questions I had regarding the technology aspect of the program.

Yes No

20. I enjoyed having the Wizards of Motion technology in my classroom.

Yes No

21. The technology aspect of the program added value to my students learning experience.

Yes No

Please comment on what you LIKED about the program.

Please comment on what you would CHANGE about the program.

Appendix 5 - Student Satisfaction Survey

Please check the BOX that is the best answer for each question.

1. I enjoyed the Wizards of Motion presentation.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

2. I learned something new about the science of human movement from the Wizards of Motion program.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

3. There was a lot of time for me to work with other people in my class.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

4. The Wizards of Motion team was very friendly.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

5. I found the Wizards of Motion presentation interesting.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

6. I think the Wizards of Motion presentation could have been more interactive.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

7. I learned something new about the science of helmets from the Wizards of Motion program.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

8. I was bored in the Wizards and Motion Program.
   Strongly Agree
   Agree
   Disagree
   Strongly Disagree

9. I did not learn anything new from the Wizards of Motion program.
   Strongly Agree
   Agree
   Disagree
   Strongly Disagree

10. I felt involved in the Wizards of Motion presentation.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

11. The Wizards of Motion team was able to answer all of my questions.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

12. The Wizards of Motion team made sure I understood the information.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

13. I felt comfortable asking any questions I had.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

14. It was easy for me to ask questions to the Wizards of Motion team.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

15. I wish I had been able to work more with my peers.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

16. I enjoyed learning about the technology the Wizards team brought into our classroom.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

17. I liked that the Wizards team brought the head drop system (the helmet tester) into our classroom.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

18. It was easy for me to talk to the Wizards of Motion team.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

19. I think we should have more chances to use technology in our class.
    Strongly Agree
    Agree
    Disagree
    Strongly Disagree

20. I would like to the Wizards of Motion team to come back to our classroom.
    Yes No

21. **<u>Prior</u>** to participating in the Wizards of Motion Program how interested were you in science and technology? *(Please circle the most appropriate statement)*
    a. Very Interested
    b. Somewhat interested
    c. Not at all interested

22. **<u>After</u>** participating in the Wizards of Motion Program would you say you are now, in general: *(Please circle the most appropriate statement)*
    a. More interested in science and technology
    b. Equally interested in science and technology
    c. Less interested in science and technology

23. **<u>After</u>** participating in the Wizards of Motion Program, how interested are you in science and technology as an area of study:
    a. More interested in science and technology as an area of study
    b. Equally interested in science and technology as an area of study
    c. Less interested in science and technology as an area of study

24. **<u>After</u>** participating in the Wizards of Motion Program, how interested are you in science and technology as a career choice:
    a. More interested in science and technology as a career choice
    b. Equally interested in science and technology as a career choice
    c. Less interested in science and technology as a career choice

25. Name **3** things you liked about the Wizards of Motion Program.

    1.

    2.

    3.

26. Name **3** things you would to change about the Wizards of Motion Program

    1.

    2.

    3.

Appendix 6 - Delivery Team Log

Delivery Team members present: ______________________

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Date: ______________________ School: ______________________

Was there appropriate contact with the schools prior to your visit? Describe any issues/concerns.

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Describe the space provided for the program. Describe the pros and cons for this location.

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Describe any technical issues that arose during the presentation. Describe the issue and how it was resolved.

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Was the program delivered as intended? Provide a description and reasoning for the necessary deviation.

Describe the student's reaction to technology introduced in the program.

Describe how you (the delivery team) provided feed to students.

Describe the interaction/collaboration which occurred between the students.

Describe the interaction which occurred between the students and the delivery team.

Any additional comments you wish to provide

Appendix 7 - Satisfaction Survey -Goodness of Fit Results

Question #	Frequency of Strongly agree	Frequency of Agree	Frequency of Disagree	Frequency of Strongly Disagree	Chi Square Value (Goodness of fit)
1	10	25	2	2	36.18
2	17	20	2	0	32.08
3	2	11	22	3	27.05
4	24	14	1	0	40.28
5	9	29	1	0	55.66
6	6	25	6	2	32.89
7	19	18	2	0	31.66
8	3	7	22	6	22.84
9	0	6	13	20	23.05
10	2	17	17	2	23.68
11	8	22	7	1	24.95
12	17	19	2	0	30.84
13	8	25	6	0	35.36
14	11	19	8	0	19.47
15	13	13	11	2	8.48
16	15	20	3	0	23.74
17	24	14	1	0	40.28
18	9	22	7	1	24.08
19	20	16	3	0	29.21