

Effects of Attitudes, Subjective Norms,
Self-Efficacy, and Bike Rodeo
Participation on Intention to Bike Safely

by

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ABSTRACT

Thousands of children are being injured every day in bicycling accidents. Interventions, like Safe Routes to School, are currently in place to combat injury rates by providing programs to teach children safe biking behaviors. In order to develop effective behavioral change programs, behavior and the components of which it is composed must be understood. Attitudes, subjective norms, and self-efficacy are important predictors of intention to perform a behavior. The purpose of this study was to ascertain the extent to which attitude, subjective norms, self-efficacy, and bike rodeo participation explain third through eighth graders' intentions to bike safely. These constructs were tested using a survey research design in a purposive sample of fifty-seven third through eighth grade students in Safe Routes to School schools in the Southwest. Students took an online survey in the computer lab at their respective schools supervised by a teacher. The study found attitudes to be comprised of three factors: happy/safe, not afraid, and calm. Overall, the model explained approximately 71% of the variance in children's intentions to bike safely, $R^2=.749$, Adjusted $R^2=.713$, $F(7, 49)=20.854$, $p<.01$. The significant predictors were happy/safe attitudes, subjective norms, self-efficacy, and a quadratic self-efficacy term explaining 10% ($p=.019$), 28% ($p<.01$), 18% ($p<.01$), and 15% ($p<.01$) respectively. The results of the study can be used to create future and improve current bike safety interventions for children.

DEDICATION

I would like to dedicate this paper to a friend of mine who I will see again someday after this life is over, Matt King (March 19, 1987 – April 19, 2010). Matt was a swing dancing friend of mine who was a mathematical genius, a dedicated Christian, and an avid cyclist. After being hit by a truck while cycling to the food pantry where he regularly volunteered, Matt's death raised bicycle awareness in Charlottesville, Virginia. Matt, I want this paper to be a drop in the bucket of your far-reaching legacy. I only hope that this small research project can lead to interventions that can save others from what you had to experience. Love and miss you, friend. Save a dance for me in heaven.

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Chapter 1

INTRODUCTION

What is Biking?

Bicycles have many uses in today's society. Moreover, there are many different forms of biking as exercise and recreation, including street cycling, mountain biking, and cruising. Biking is also a growing form of regular transportation; nationally, biking trips have increased from 1.7 billion to 4 billion since 1990 (The University of North Carolina Highway Safety Research Center [UNCHSRC], 2010). There is a trend of bike sharing as an extension of public transportation which has prospered in many major metropolitan cities both nationally and internationally (L. Jones [B-cycle] & G. Crivello [Bixi], personal communication, January 18, 2011). This study examines biking as a means of transportation for 3rd through 8th grade students to and from school and the safety with which they are riding.

Biking Injury Statistics

In the year 2005 alone, 103 children were killed in bicycle-related incidents. In 2000, 370,317 child bicyclists were injured, which means on average, approximately 1,000 children are injured per day while bicycling. These statistics are based on emergency department visits, which may indicate the severity of the injuries (National Center for Injury Prevention [NCIP], 2000;2005). In fact, there are more childhood emergency room incidents related to biking than to any other sport (Brain Injury

Association of America. Bicycle Safety. [Fact Sheet] McLean (VA): BIA, April 2001), and, other than motor vehicles, bicycles are related to more injuries in children than any other consumer product (Wilson, Baker, Teret, Shock, & Garbarino, 1991).

Agencies Involved with Biking Safety

These injury statistics show that biking safety is a national concern and the necessity of supportive safety organizations. Many agencies advocate awareness and provide resources for solutions. Some of these agencies and programs include Safe Kids USA, KidsHealth from Nemours, United States Department of Transportation, National Highway Traffic Safety Administration, Bicycle Helmet Safety Institute, and Safe Routes to School. The National Highway Traffic Safety Administration is taking strides to change these statistics by setting forth traffic safety initiatives and offering funding to complying departments of transportation (National Highway Traffic Safety Administration, 2006).

Safe Routes to School

Safe Routes to School (SRTS) is a leader among organizations providing programs to support and grow bicycle (and pedestrian) safety. The international organization originated in 1970 in Odense, Denmark. The national program was adopted in the United States in 2005 by Section 1404 of the federal transportation bill *Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users Act*. The goal of SRTS is to simultaneously make routes to school safer while encouraging

more children to walk and bike to school (in the safe routes). SRTS uses the concept of 5Es (education, engineering, enforcement, education, and evaluation) as guiding strategies to meet these goals. By April of 2007, every state and the District of Columbia hired interim or full-time SRTS coordinators for the state (UNCHSRC, 2010). SRTS continues to grow, and since 2005, the national apportionment has risen from \$51,000,000 to \$180,000,000 (National Center for Safe Routes to School, 2009).

Bike Rodeos

Bike rodeos are often integrated into SRTS programs, although they have not become mandatory. Bike rodeos are a five-station obstacle course geared at teaching participants real world bicycling skills by simulating traffic conditions cyclists are likely to encounter. These stations include Bike Basics, Driveway Dangers, Intersection Inspection, See and Be Seen, and Road Risks (Valley Metro, 2010). Smithville, Texas; Omro, Wisconsin; Vacaville, California; Tampa, FL; Boulder, CO; Cleveland, OH; Bellingham, Washington; and Burgin, Kentucky are just a few examples of cities offering Bike Rodeos in conjunction with their SRTS programs (National Center for Safe Routes to School, 2010).

Current Bicycle Safety Research

As far as bicycle safety research goes, a vast majority of the literature focuses solely on helmet use. The literature review section rightly reflects the literature in the field, which gives the impression that helmets are the only item of value regarding bicycle safety. Conceptually,

this argument makes as much sense as only focusing on seat belts when researching automobile safety, when it is known that seat belts are not the only measure that prevents a driver or passenger from getting injured; avoiding the collision or accident is the best way to evade injury. This new holistic view of bike safety in no way means that one should not wear a seat belt (or a helmet); it just means that there is a bigger picture. In the same thread, research on bicycle safety should begin to encompass safe riding practices and other preventative measures.

Theory of Planned Behavior to Help Predict Intention

Bicycling safety, and preventing death in bicycling incidents, is a large public concern (Finnoff, Laskowski, Shock, & Garbarino, 1991). The injury statistics must be changed, and changing behavior is largely done through interventions. The theory of planned behavior provides an excellent basis to begin a behavioral prediction study (Ajzen, 1991). As a behavioral prediction model, the end of the model is the behavior itself. Intention is the direct antecedent to behavior being a function of attitude toward the behavior, subjective norms, and perceived behavioral control. Each of these three constructs is a function of underlying behavioral beliefs, normative beliefs, and control beliefs respectively. So according to the model, in order for a behavior to take place, there needs to be positive intention to perform that behavior, which is fueled by a positive attitude toward the behavior, positive social norms concerning that behavior, and a positive self-efficacy about that behavior (Ajzen, 1991). This study is not

an application of the theory of planned behavior; rather this theory provided the theoretical springboard on which the study model is based.

Importance of Intention

In regards to health and leisure behaviors, intention can be the end product of a particular study (Evans & Norman, 2003). Evans and Norman (2003) predicted road-crossing intentions of adolescents, and Quine, Rutter, and Arnold (2001) studied helmet use intentions of school-age cyclists. Although there has been a more recent model with more constructs intersecting the path from intentions to behavior (Fishbein, 2000; 2008), intention is still the best single predictor of behavior (Buhi & Goodson, 2007; Fishbein, 2000; 2008; Fishbein & Cappella, 2006).

Problem of the Study

The problem of this study was to analyze the extent to which attitudes, subjective norms, self-efficacy, and bike safety intervention predicted children's intentions to bike safely.

Purpose of the Study

The purpose of this study was to add a holistic perspective to bicycle safety using a behavioral prediction model. Most of studies concerning bicycle safety primarily revolve around helmet use and related issues. There is a lack of studies that address bike safety as a complete concept in predicting behaviors, where complete concept is defined as encompassing more facets of safe biking than helmet use alone.

Delimitations

The scope of the study was delimited to:

1. Children attending school in third through eighth grade
2. Schools with access to a bike rodeo in the last two years
3. Schools in Maricopa County, Arizona

Limitations

The generalizability of the study results were limited by the sample size. The small sample size was due to two main reasons. First, many parents did not give their child consent. Second, teachers were not able to grant all consented students access to take the survey. However, the sample and population demographics were compared, and no significant differences were found. The ethnic and gender distribution of the sample mirrors the ethnic and gender distribution of the state of Arizona (U.S. Census Bureau, 2009). Additionally, the analyses used were limited by multiple regression which did not allow for more extensive analysis between the independent variables, which could be analyzed using other techniques such as structural equation modeling.

Hypotheses

The following null hypotheses were tested:

H1: Attitudes have no effect on intention, $H_0: \beta_{attitudes} = 0$, $\alpha = .05$

H2: Subjective norms have no effect on intention, $H_0: \beta_{norms} = 0$,
 $\alpha = .05$

H3: Self-efficacy has no effect on intention, $H_0: \beta_{self-efficacy} = 0$, $\alpha = .05$

H4: Bike rodeo participation has no effect on intention, H_0 :

$$\beta_{\text{rodeo}} \neq 0, \alpha = .05$$

H5: The full model is not useful in explaining variance in intention,

$$H_0: R^2 \neq 0, \alpha = .05$$

Chapter 2

LITERATURE REVIEW

This literature review covers research on attitudes, subjective norms, self-efficacy, and intention, and their relation to health and leisure behaviors as well as a review of bicycle safety research. The hypothesized relationships are depicted in Figure 1 (p.25). Previous literature supports the listed hypotheses.

Attitudes

An attitude is an individual's positive or negative assessment of performing the behavior (Rivis & Sheeran, 2003). Attitudes affect the behavior by directly affecting the intention to perform the behavior (Armitage & Conner, 2001). Attitudes are normally measured through a semantic differential scale, which Ajzen, the father of the theory of planned behavior, supports (Ajzen, 1991). However, others found that semantic differential scales were weaker than expectancy-value scale (Bagozzi, 1981). Semantic differential scale items are constructed by using two opposing ideas and asking the respondent to choose which idea most closely matches his or her evaluation of the behavior (Bagozzi, 1981).

Regardless of the means of measurement, attitudes have been an important predictor of intention and behavior in many studies (Sheppard et al., 1988). Negative attitudes towards helmet use in teenagers were explored in order to be able to target those precursor beliefs causing the

negative attitude, with the end desire to eventually convince teenagers to wear helmets. The negative beliefs most closely associated with the negative attitude related to appearance and comfort (Finch, 1996). Another study investigated gender differences in attitudes towards eating sweet snacks, predicting that women would have more of a negative attitude than men. Although the hypothesis was not supported, attitudes were still seen to have been a good predictor of intentions (Grogan, Bell, & Conner, 1997). Attitudes also had strong predictive power towards intention to donate blood (Bagozzi, 1981). As the literature shows, attitudes, and their direct affect on intention, have been documented and supported in many studies, including those concerning health and leisure behaviors.

Subjective Norms

Subjective norms refer to the perceived social pressure the individual experiences surrounding the behavior in question; another term for this idea is injunctive social norms (Rivis & Sheeran, 2003). This social pressure comes from the persons closest to the individual that have influential capabilities (Ajzen, 1991); these individuals may be family members, friends, co-workers, or children (Buhi & Goodson, 2007). An item to measure these subjective norms would ask if a certain important person would say that one should or should not perform the behavior. This can then be multiplied by one's "motivation to comply" (p. 218) with the views of the important people (Rivis & Sheeran, 2003). Subjective

norms influence behavior by their impact upon intentions. The perception of positive support of the behavior lends a positive intention to perform the behavior (Armitage & Conner, 2001). The subjective norm construct tends to be the weakest construct in predicting intentions (Armitage & Conner, 2001; Ravis & Sheeran, 2003). This weakness may be due to improper measurement, since many of the studies used a single-item indicator to measure subjective norms (Armitage & Conner, 2001).

Subjective norms have been used in many studies and have shown to be a useful predictor of health behaviors. In Buhi and Goodson's (2007) study, perceiving that friends are having more sex was a predictor for adolescents to have more sex themselves. This study models the above description that perception of a favorable opinion of the behavior leads to a positive intention to perform the behavior. For an example of the adverse case, misperceptions of norms have been shown to have a great negative effect on elementary school children wearing a helmet (Howland et al., 1989), meaning that a perceived negative view of a behavior offered a negative intention to perform that behavior. Together, attitudes and subjective norms account for 33 to 50 percent of the variance in intentions (Ajzen, 1991; Armitage & Conner, 2001; Sheeran & Taylor, 1997; Ravis & Sheeran, 2003).

Self-Efficacy

Self-efficacy is the confidence in oneself and one's capability to perform a behavior (Bandura, 1977; Baranowski, Perry, & Parcel, 2002)

and has been identified as one of the most important predictor of behavioral change (Bandura, 1977). Efficacy expectations are created through four sources: personal accomplishments, vicarious experience, persuasion, and physiological states (Bandura, 1977). Self-efficacy accounts for an additional 7% of intention prediction, above and beyond the contribution of attitude and subjective norms (Armitage & Conner, 2001) and has a positive relationship with behavioral change (Bandura, 1977). One of its major strengths is that self-efficacy is behavior specific; it is not a broad over-arching life capability (Bandura, 2006).

Self-efficacy and perceived behavioral control, the original construct in the theory of planned behavior (Ajzen,1991) are closely related constructs, but self-efficacy has greater empirical support for predicting intentions and behavior (de Vries, Dijkstra, & Kuhlman, 1988; Dzewaltowski, Noble, & Shaw, 1990; Manstead & van Eekelen, 1998; Terry & O’Leary, 1995; White, Terry, & Hogg, 1994) and is also used in more recent and more comprehensive models of behavioral prediction (Fishbein, 2000; 2008). As far as its efficacy in health and leisure studies goes, in a study concerning safe sexual behaviors, it negotiated safer sex in eleven instances (Buhi & Goodson, 2007) and predicted intentions to discuss condom use with a partner (Terry & Hogg, 1994). In a study predicting exercise behavior, self-efficacy predicted intentions very well (Terry & O’Leary, 1995).

Intentions

Based on the model, intentions are the proposed result of the three previously explained constructs; the stronger the positive intention, the higher the likelihood of performing the behavior (Ajzen, 1991). This construct should illustrate the motivation behind performing the behavior. Intentions are important to study because they are the best single determinant of behavior (Buhi & Goodson, 2007; Fishbein, 2000; 2008; Fishbein & Cappella, 2006). Intentions can be accurately predicted from attitudes towards the specific behavior, subjective norms surrounding the specific behavior, and perceived behavioral control concerning the specific behavior (Sheppard et al., 1988).

Behavior

Behavior is defined by target, context, action, and time, and that same specificity must be maintained throughout all other constructs in regard to the behavior (Ajzen, 1991; Fishbein, 2008; Sheppard et al., 1988). Also, a behavior is a behavior and not a goal; while that seems like a simplistic statement, goals have far-reaching constraints that cannot be seen or perceived by the individual. Lastly, in order to question an individual about a behavior, his or her intention to perform the behavior, or his or her attitude, subjective norms, and self-efficacy toward the behavior, the individual must know and understand the behavior (Ajzen, 1991).

Bicycle Safety

Injury and accidents.

Children make up approximately 70 percent of reported bicycle-related injuries, both fatal and nonfatal (Kraus, Fife, & Conroy, 1987). Head and brain injuries are likely consequences to serious bicycle accidents (Kraus, et al., 1987) as are face, neck, and abdomen injuries (Grimard, Nolan, & Carlin, 1995). Approximately 90 percent of bicycle related deaths and 3 to 85 percent of nonfatal bicycle injuries involved collision with an automobile (Kraus, et al., 1987). The highest incidence of bicycling brain injury occurs at ages 5-9 for females and 10-14 for males where the annual incidence is 13.5 injuries per 100,000 people (Kraus, et al., 1987). Nineteen to twenty-five percent of all bicycle-related brain injuries occur with children less than 14 years old (Kraus, et al., 1987; Gallagher, Finison, Guyer, & Goodenough, 1984; Ivan, Choo, & Ventureyra, 1983; Klauber, Barrett-Connor, Marshall, & Bowers, 1981). The morbidity and mortality rates annually cost the United States over \$1 billion (Sacks, Holmgreen, Smith, & Sosin, 1991). Other nonfatal wounds can include a multitude of fractures: skull, humerus, forearm and elbow, scaphoid, lower limb, clavicle, and other minor ones (Illingworth, Noble, Bell, et al., 1981). In one study of 150 bicycle injuries in children, 17.3% of the accidents were caused by a collision with an obstruction: stone, pothole, speed bump, or grate; 16% were due high speeds or loss of control; and 14.7% were due to skidding on gravel or around a curve. The other children in the study either pulled a 'wheelie,' rode two to a bicycle, collided with another bicycle, collided with a parked car, tumble over the

handlebars when braking quickly, and fell due to various reasons. These reasons include swerving, when the foot slipped off the bicycle pedal, when brakes failed, during a gear malfunction, when the wheel came off, due to an ill-fitting bicycle, because of dogs, after the removal of brake blocks, and after collision with an automobile (Illingworth, et al., 1981). The reasons for these accidents are common with other studies (Illingworth et al., 1981; Waller, 1995)

Helmet efficacy.

In order to combat head and brain injuries, helmet use is encouraged because wearing a helmet reduces the seriousness of head injuries in accidents (Dorsch, Woodward, & Somers, 1987; Grimard, et al., 1995; Thompson, Rivara, & Thompson, 1989). The hard-shell helmet with the polystyrene liner is the most protective type of helmet, beyond racing-style or hard-shell with soft inner lining (Dorsch, Woodward, & Somers, 1987). This good type of helmet produced smaller amounts of concussions, skull fractures, scalp bruising, and facial lacerations, but larger amounts of soft tissue injury to the scalp or face (Dorsch, Woodward, & Somers, 1987). Children who wear helmets tend to have as many facial injuries as those who do not, but children who wear helmets tend to have milder injuries overall (Grimard, et al., 1995). Helmets have been conservatively shown to overall reduce the risk of brain injury by 58 to 88 percent, head injury by 60 to 85 percent (Thompson, et al., 1989; Attewell, Glase, & McFadden, 2001), facial injury by 33%, fatal injury by

73%, and a statistically insignificant increase risk in neck injury (Attewell, Glase, & McFadden, 2001). The American Academy of Pediatrics supports the use of helmets that are approved by the American National Standards Institute (ANSI) or the Consumer Product Safety Commission (CPSC; Committee on Accident and Poison Prevention, 1990).

Helmet use.

Despite the risk of injury and the known protectiveness of helmets, helmet use tends to be low. In 1991, 26% of children owned helmets, with 86% of those being the support hard-shell with the polystyrene inner padding, but only 15% of the children wore them all or most of the time (Rodgers, 1996). Children are more likely to wear helmets if they are under 12, have experienced a bicycle accident that required medical attention, or if their parents attended college (Rodgers, 1996). Another study, in 1986 in Tucson, Arizona, found that less than 2% of school-aged child bicyclists wore helmets while riding to and from school (Weiss, 1986) and was up to 17.1% in 1992 (Weiss, 1992). The range of 2-17% is still a very low percentage when considering the amount of time they spend on their bike. Approximately 27.7 million children ride bicycles (Sacks, et al., 1996) approximately 300 hours annually (Rodgers, 2000). That is a large number of children riding for a long amount of time without wearing a helmet.

Attitudes and barriers to helmet use.

Since the facts of helmet protectiveness and risk of injury are there,

why are children not wearing helmets? This question is generally answered by means of attitude and social or peer pressure (Howland, Sargent, Weitzman, et al., 1989; Coté, Sacks, Kresnow, et al., 1992;). A qualitative study posits that attitudes were a major barrier to helmet use by elementary school children (Howland et al., 1989). Attitude in this study would be explained by words such as stupid, not cool, embarrassing, and not tough. Perceived social pressure was found after asking children about what their friends would think if they wore a helmet. Answers ranged from being called stupid and ugly, being laughed at, being called names, being called a sissy, and not being seen as tough (Howland et al. 1989). Thirty-one percent of teenagers find helmets uncomfortable, while 22% think helmets are unfashionable (Finch, 1996). Another main reason helmets are not worn is simply because people do not own them (Finnoff, et al., 2001; Berg & Westerling, 2001; Howland et al., 1989; Pendergast, Ashworth, DuRant, & Litaker, 1992; Graitcer, Kellermann, & Christoffel, 1995).

Safety Interventions

The only way to combat the barriers listed above is to intervene in some way; legislation and education are the mediums previously under investigation.

Legislation.

The enactment of a bicycle helmet law does increase helmet use significantly but only as much as it is enforced (Gilchrist, Schieber,

Leadbetter, & Davidson, 2000; Coté et al., 1992; Dannenberg, Gielen, Beilenson, Wilson, & Joffe, 1993; Macknin & Medendorp, 1994). The community support for the law, the probability of detection of violation, and the quickness and weight of punishment are much better predictors of increased helmet use than the presence of the law itself (Coté et al., 1992). Also, when the enactment of a law is preceded by a great deal of education regarding the law, helmet use tends to increase significantly more and the effect tends to be prolonged (Coté et al., 1992; Dannenberg et al., 1993). Still, a large percentage of people who still disregard the law remain (Gilchrist et al., 2000)

Education.

Education is meant to bridge the gap between the law or the idea and the individual, and in fact, when combined with legislation, makes a much larger impact than legislation alone (Graitcer, et al., 1995). Education programs in existence have a tendency to focus on helmet use and the importance of wearing a helmet (Coté et al., 1992; Graitcer, et al., 1995, Dowswell, Towner, Simpson, & Jarvis, 1996; Dannenberg et al., 1993; Gilchrist, et al., 2000; Nixon, Clacher, Pearn, & Corcoran, 1987) and may be performed by police officers (Gilchrist et al., 2000), teachers (Carlin, Taylor, & Nolan, 1998; Pendergrast et al., 1992; Quine, Rutter, & Arnold, 2001; Towner & Marvel, 1992; Nagel, et al., 2003), medical personnel (Cushman, Down, MacMillan, & Waclawik, 1991; Cushman, James, & Waclawik, 1991), or concerned community members (Schneider,

et al., 1993, Rivara et al., 1994). Large community-wide educational programs, supported by education, media, and concerned community members have the best and most lasting impact (Schneider, Ituarte, & Stokols, 1993, Rivara et al., 1994).

Chapter 3

METHODOLOGY

The purpose of this study was to determine the extent to which attitudes, subjective norms, self-efficacy, and bike rodeo participation predicted children's intentions to bike safely.

Population Analyzed

The population analyzed in this study was third through eighth grade students in Safe Routes to School pilot schools of Maricopa County. The participants were sampled from the schools receiving funding through Arizona Department of Transportation grants. They were identified through their participation in the Safe Routes to School program, which encourages holding at least one bike rodeo each year. This study used a purposive sample because one of the independent variables is participation in a bike rodeo, and they have the resources to host a safety intervention. These schools also agreed to undergo evaluation for these Safe Routes to School programs.

Pilot Study

A pilot study was conducted with students in 3rd through 8th grade, some of which participated in a classroom computer lab setting. The results of this study were significant, and there were no major qualms with the survey items.

Instrument

The instrument used in this study was a 36 question online survey. The items in this survey follow methods used in prior research on Safe Routes to School programs and guidelines set by Ajzen (2006). Attitudes were measured by items 18 through 24, subjective norms were measured by items 33 through 36, self-efficacy was measured by items 29 through 32, bike rodeo participation was measured by item 11, and intention was measured by items 25 through 28. There are multiple concepts that create the encompassing idea of bicycle safety which have not previously been researched and their importance has been determined important through a review of national programs, the Center for Disease Control's Kidswalk, SafeKids USA, and Safe Routes to School. The overall topics for the questions were selected by the most frequently cited tips and facts that the leading bicycle safety program for children hosted on their respective web pages. Those tips were wearing bright or reflective clothing while riding a bike, obeying traffic signs and signals, riding on the street with traffic if you are over 10 years old, not playing around in the road when riding a bike, and wearing a properly fitted helmet.

All primary constructs have multiple item indicators except for bike rodeo participation. The four constructs are attitude, subjective norms, self-efficacy, and bike rodeo participation. Attitudes were measured through items 18-24 on a 3-point Likert-type scale: not at all, a little, very much. Subjective norms were measured through items 33 through 36 on a 4-point Likert-type scale: never, some of the time, most of the time, all the

time. Self-efficacy was measured through items 29 through 32 on a 4-point Likert-type scale: never, some of the time, most of the time, all the time. Bike rodeo participation was measured through item 11, where the students indicated how many bike rodeos they had attended: 0, 1, 2, 3, 4, 5 or more. Intention was measured through items 25 through 28 on a 4-point Likert-type scale: never, some of the time, most of the time, all the time. The secondary variables, such as age, grade, sex, and ethnicity, were measured through items 2, 3, 4, and 5 accordingly. The instrument and consent form underwent IRB approval, and the stamped copies of those two forms are available in Appendices A, B, and C, respectively. The survey was created through the Qualtrics program (Qualtrics Labs, Inc., Provo, UT) and was administered as an online assessment.

A power analysis was conducted using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007). A total of 46 participants were necessary to maximize the statistical significance/power relationship given the statistical tests used in this study.

Procedures

Two schools within the Safe Routes to School program who had access to a bike rodeo agreed to go forth with the evaluation, so permission/consent forms were delivered to Burk Elementary and Ashland Ranch Elementary. Burk Elementary has a total of 269 students in third through sixth grade and Ashland Ranch Elementary has 540. The total sample size was 65. Sixty-five students' teachers agreed to invite

students to take the survey. From the sample, thirty-six completed the survey with consent and assent. Primary reasons cited for refusal to participate included: parents not signing and returning consent form, and busyness of teachers disallowing students to access the survey; the survey window was during AIMS (Arizona's Instrument to Measure Standards) testing season.

The survey was accessed by the students through the computer labs at school under the supervision of the teacher. The teachers were instructed to share the link with the students, and then allow the students to take the assessment on their own. The students were only allowed to grant assent to continue to take the survey if their parents signed and returned the consent form. The students accessed the survey March 8, 2011 through April 5, 2011. The data were collected and analyzed with the PASW Statistics 18 program (SPSS for Windows, 2009).

Chapter 4

DATA ANALYSIS AND RESULTS

Analysis of Data

The problem of the study was to analyze the extent to which attitudes, subjective norms, self-efficacy, and bike rodeo participation explain children's intentions to bike safely. This section identifies the demographics of the population studied, the reliability of the instruments, and the results of the study. These results are reported in the format of the correlations between each of the independent variables and the dependent variables, regression coefficients, and related significance tests.

The analysis conducted for this study was as follows:

1. Descriptive statistics
 - a. Mean
 - b. Standard deviation
 - c. Scatterplot
 - d. Factor Analysis
2. Spearman correlation
 - a. Attitudes & Intention
 - b. Subjective Norms & Intention
 - c. Self-Efficacy & Intention
 - d. Bike Rodeo & Intention
3. Multiple Regression

A linear model for intention was explored that included attitudes, subjective norms, self-efficacy and bike rodeo participation, plus demographic variables such following:

$$Int = \beta_0 + \beta_1 Eth + \beta_2 Gen + \beta_3 Age + \beta_4 Grade + \beta_5 Att + \beta_6 Norm + \beta_7 SelfEff + \beta_8 BikeRodeo + \varepsilon$$

A multiple regression analysis was conducted to estimate the full model and alternatives with interactions between variables and variable slopes. The goal of the analysis was to find a best fitting but parsimonious relationship where the controls are a VIF > 1.0 and $\alpha = .05$. Expectations were that each of four major constructs had positive and significant effects on intention. Hypothesized relationships can be seen in Figure 1.

The sample size of 57 for this study includes the pilot study. The results of the analysis of the data without the addition of the pilot study were very similar to the results with the pilot study. A comparison of the pilot study and the sample can be seen in Appendix F. The pilot study is included in the sample size for the remainder of the analyses.

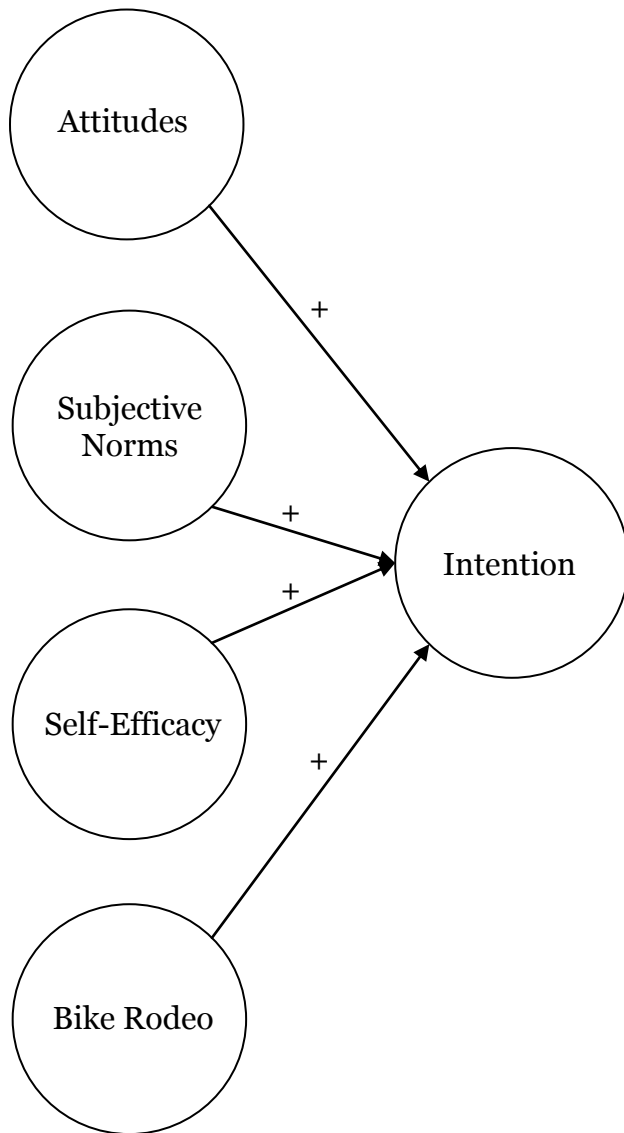


Figure 1. The hypothesized research relationships of attitude, subjective norms, self-efficacy, bike rodeo participation, and demographic variables.

Results

Response Rate

The reported response rate for this study is 58%. This score was calculated using the sample without the pilot study. Within the same, 62 students were allowed by their teacher to take the survey and 36 of the 62 had consent and could have assented to taking the survey. Consent forms were distributed to 269 students at one primary school in Maricopa County and 540 students at another. More students could have been given consent and could have assented to taking the survey, but the known sample size (62) is only based on the students whose teachers fostered the data collection.

Demographics

The sample included 52.1% boys and 47.9% girls. The sample included varying ethnicities: 62% White, 25.4% Latino or Hispanic, 7% Black, and 2.8% Asian. The gender and ethnic spread closely mirror the general composition of Maricopa county and Arizona as a whole (U.S. Census Bureau, 2009). The grades ranged from third through eighth with 1.4% in third grade, 40.8% in fourth grade, 16.9% in fifth grade, 32.4% in sixth grade, 2.8% in seventh grade, and 4.2% in eighth grade. The total sample size was 57 students, including the pilot study.

Factor Analysis

An exploratory principal components factor analysis was performed within constructs to determine the amount of components measured

within each factor. All primary constructs showed each to be of a single component, except attitudes. Factor loadings of the attitude items are shown in Table 1.

Table 1

Component loadings for the 7 attitude items with a varimax rotation

Component	1	2	3
To what extent do you feel the following when you are biking in safe manner – Happy	.578		
To what extent do you feel the following when you wear your helmet when riding a bike – Happy	.815		
To what extent do you feel the following when you wear your helmet when riding a bike – Safe	.820		
To what extent do you feel the following when you are biking in safe manner – Afraid		.842	
To what extent do you feel the following when you wear your helmet when riding a bike – Afraid		.924	
To what extent do you feel the following when you are biking in a safe manner – Calm			.935
To what extent do you feel the following when you wear your helmet when riding a bike – Calm			.588
Eigenvalues	2.330	1.667	1.025
Percentage of total variance	33.290%	23.807%	14.647%
Number of test measures	3	2	2

Note. Only factor loadings >.5 were retained

The components were saved into primary variables named Happy/Safe (Component 1), Not Afraid (reverse-coded Component 2), and Calm (Component 3). The means were calculate for all primary variables and used for the duration of the analyses. The descriptive statistics for these primary variables can be found in Table 2. Correlations between the primary variables can be found in Table 1; significant correlations have been flagged.

Table 2

Descriptive statistics for the regressors

Variable	Mean	Std. Deviation	Skewness	Kurtosis	Cronbach's α
Happy/Safe	2.5028	.5148	-.801	-.111	.708**
Not Afraid	2.6754	.5303	-1.594	1.905	.753**
Calm	2.6230	.4971	-1.151	.649	.467
Norm	3.1503	.6294	-.717	-.053	.643*
Self-Efficacy	3.0833	3.083	-.662	-.525	.658*
Bike Rodeo	.6957	.6957	-.869	-1.282	#
Intent	2.7594	.8188	-.319	-.958	.791**

**Cronbach's $\alpha > .7$

*Cronbach's $\alpha > .6$

Bike Rodeo participation was a single-item indicator

Reliability Diagnostics

Cronbach's alpha was computed for each of the scales: happy/safe, not afraid, calm, subjective norms, and self-efficacy. Nunnalley (1967) posits a Cronbach's alpha of >0.7 to be reliable, and George and Mallery (2003) posit that an $\alpha \geq 0.6$ and < 0.7 as acceptable. According to these scholars, happy/safe attitude, not afraid attitude, and intent were reliable scales; subjective norms (Norm) and self-efficacy were acceptable scales. The

calm attitude scale did not meet any reliability standards. The actual Cronbach's alphas recorded can be seen above in Table 2.

Data Transformation for Analysis

First, the items were divided by construct, where attitudes had seven items, subjective norms had four items, self-efficacy had four items, and bike rodeo participation had one item. After the exploratory factor analysis, it was determined that attitude was composed of three factors and the remaining constructs sustained one factor status. After determining the final regressors: happy/safe attitude, not afraid attitude, calm attitude, subjective norms, self-efficacy and bike rodeo participation, the mean was determined for each regressor for each individual. These mean terms were used for the duration of the analyses.

Correlations

The data were analyzed through a Spearman correlation and reported in Table 3. The happy/safe attitude was significantly correlated with the calm attitude, subjective norms, self-efficacy and intent. The not afraid attitude was not significantly correlated with any other construct. The calm attitude was significantly correlated with the happy/safe attitude and self-efficacy. Norms were significantly correlated with the happy/safe attitude, self-efficacy, and intention. Self-efficacy was significantly correlated with the happy/safe attitude, the calm attitude, subjective norms, and intent. Bike rodeo participation was not significantly correlated with any other construct. Based on these correlations, the

happy/safe attitude, norms, and self-efficacy will be important predictors of intention, while the other constructs will be less important and possibly insignificant.

Table 3

Spearman Correlations between Measures

Measure	Not Afraid	Calm	Norm	Self-Efficacy	Bike Rodeos	Intent
Happy/Safe	-.190	.289*	.415**	.365**	.055	.526**
Not Afraid		.147	-.082	.012	.072	-.055
Calm			.119	.334**	-.038	.229
Norm				.483**	.008	.681**
Self-Efficacy					-.009	.483**
Bike Rodeos						-.015

** Correlations significant at the .01 level (2-tailed)
 * Correlations significant at the .05 level (2-tailed)

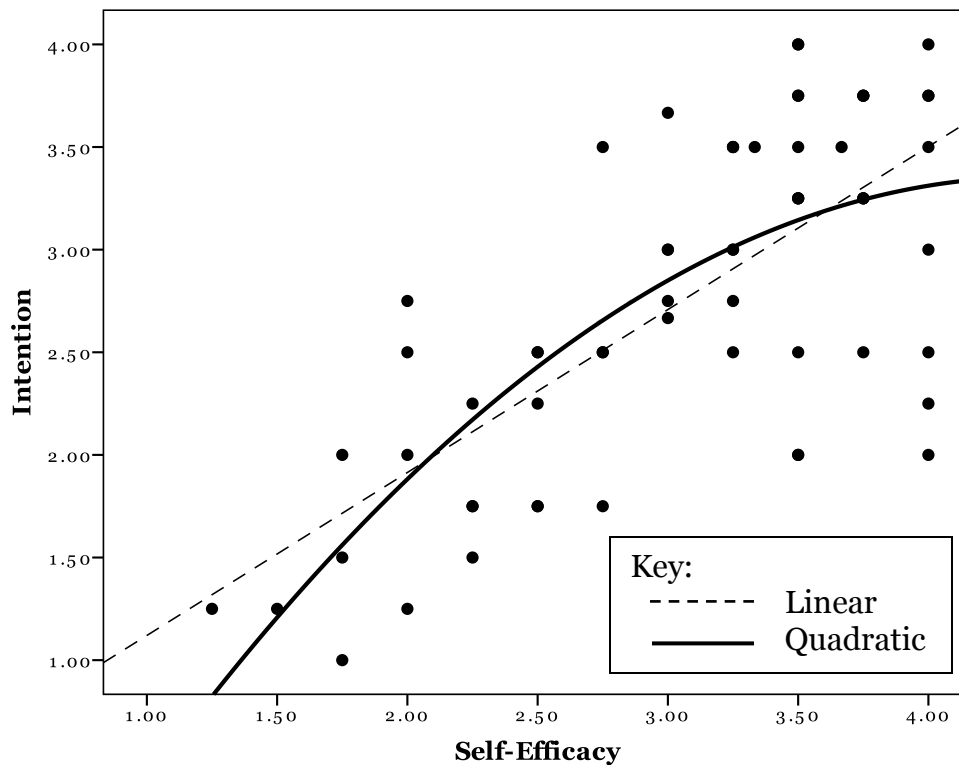
Scatterplots

Scatterplots of the relationships of each of the primary independent variables were examined with the dependent variable, intention. There were observed linear relationships between each of the independent predictors and the dependent variable, intention, except for self-efficacy. The relationship between self-efficacy and intention seems to be a curvilinear, specifically quadratic, relationship. The scatterplot depicting the quadratic relationship can be seen in Figure 2. The bolded line depicts the fit line for the quadratic relationship, where the dashed line depicts a fit line for a linear relationship between self-efficacy and intention.

In order to explore the addition and computation of the quadratic variable, self-efficacy was mean-centered. Mean-centered means

subtracting the mean from each observation. This method reduced nonessential multicollinearity between the predictors x and x^2 . Centering data in polynomial equations is a method used and encouraged by leading social scientists (Cohen, 2003). The addition of a quadratic term accounted for the rate of change of the slope of the curve of the relationship of self-efficacy to intention. The quadratic term is not a stand alone predictor; it must be used in combination with the corresponding linear predictor (Cohen, 2003). Implications and explanations of this concept can be found in the discussion and conclusions chapter. The quadratic term adds an approximate 4.4% of explained variance to the model ($\Delta R^2=.044$, F Change (1, 49)=8.668, $p=.005$) above and beyond all other predictors.

Figure 2. Relationship between Self-Efficacy and Intention



Multiple Regression

A multiple regression analysis was conducted and the model significantly explained approximately 71% of the variance of intentions to bike safely, $R^2=.749$, Adjusted $R^2=.713$, $p<.01$. Regression coefficients (standardized and unstandardized), partial r^2 , and significance tests of each predictor are shown in Table 4. The significant predictors were happy/safe attitude ($p=.019$), subjective norms ($p<.01$), self-efficacy ($p=.002$), and the quadratic self-efficacy term ($p=.005$).

Table 4

Summary of Multiple Regression Analysis of Mean Predictors on Intentions to Bike Safely (N=57)

Variable	B	SE(B)	β	Partial r^2	t	Sig.(p)	VIF
(Constant)	.518	.607			.853	.398	
Happy/Safe	.352	.145	.222	.108	2.432	.019	1.631
Not Afraid	.061	.116	.040	.006	.526	.601	1.106
Calm	-.100	.135	-.062	.011	-.738	.464	1.368
Norm	.499	.114	.382	.280	4.361	.000	1.494
Self-Efficacy	.352	.107	.326	.180	3.285	.002	1.917
Bike Rodeos	.088	.126	.051	.010	.695	.490	1.627
Self-Efficacy ²	-.348	.118	-.269	.151	-2.944	.005	1.059

Note. $R^2=.749$, Adj. $R^2=.713$, $F(7, 49)=20.854$, $p<.01$, all VIF <2.0

For the attitudinal variables, Happy/Safe was the only one to significantly explain additional variance above and beyond the other predictors (partial $r^2=.108$, $p=.019$). The subjective norm variable accounted for approximately 28% of uniquely explained variance (partial $r^2=.280$, $p<.01$). The self-efficacy relationship explains 18% of unique variance in intention to bike safely (partial $r^2=.180$, $p<.01$). The coefficients of the constructs retained in the model can be viewed in Figure 3.

Other model varieties were explored, and other investigated variables were not found to be statistically significant or lend any additional unique explanation of the variance of intention to bike safely. These variable varieties include interaction variables with Bike Rodeo (Happy/Safe * Bike Rodeo, Not Afraid * Bike Rodeo, Calm * Bike Rodeo, Norm * Bike Rodeo, and Self-Efficacy * Bike Rodeo) and demographic variables (ethnicity, age, grade level, and gender). Further discussion of these excluded variables is located in Appendix E.

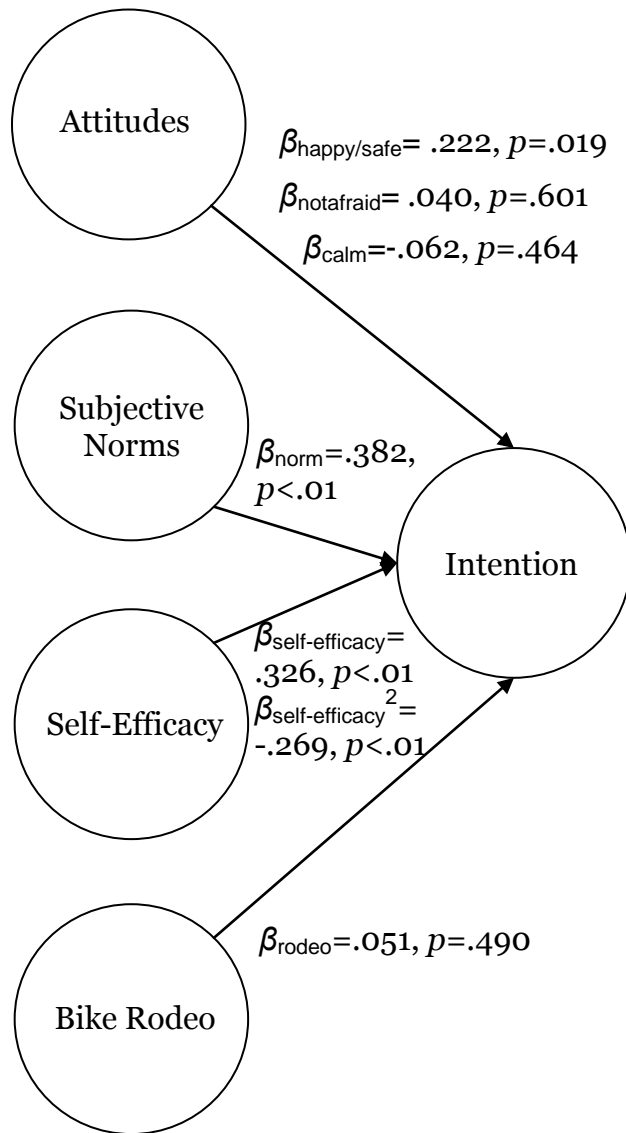


Figure 3. Relationships between the regressors and the dependent variable.

Chapter 5

DISCUSSION AND CONCLUSIONS

Summary of Findings

The goal of this study was to determine the effect that attitudes, subjective norms, self-efficacy, and bike rodeo participation had on children's intention to bike safely. The original hypotheses were compared with the results to determine the conclusions of the study.

H1_A: Attitudes have an effect on intention

H1₀: Attitudes have no effect on intention, $\beta_{attitudes \neq 0}$, $\alpha = .05$,

Result: $\beta_{happy/safe} = .222$, $p = .019$, $\beta_{notafraid} = .040$, $p = .601$,

$\beta_{calm} = -.062$, $p = .464$, $F(3, 49) = 1.976$, $p = .130$

Conclusion: Fail to reject the null hypothesis

H2_A: Subjective norms have an effect on intention.

H2₀: Subjective norms have no effect on intention, $\beta_{norms \neq 0}$, $\alpha = .05$

Result: $\beta_{norms} = .382$, $p < .01$

Conclusion: Reject the null hypothesis

H3_A: Self-efficacy has an effect on intention.

H3₀: Self-efficacy has no effect on intention, $\beta_{self-efficacy \neq 0}$, $\alpha = .05$

Result: $\beta_{self-efficacy} = .326$, $p < .01$, $\beta_{self-efficacy^2} = -.269$, $p < .01$

Conclusion: Reject the null hypothesis

H4_A: Bike rodeo participation has an effect on intention.

H4₀: Bike rodeo participation has no effect on intention, $\beta_{rodeo \neq 0}$,

$\alpha = .05$

Result: $\beta_{\text{rodeo}}=.051, p=.490$

Conclusion: Fail to reject the null hypothesis

H_{5A}: The full model is useful in explaining variance in intention.

H_{5o}: The full model does not explain any variance in intention,

$R^2 \neq 0, \alpha=.05$

Result: $R^2=.749, \text{Adjusted } R^2=.713, F(7,49)=20.854, p<.01$

Conclusion: Reject the null hypothesis

The study successfully rejected three hypotheses, which is interpreted as subjective norms have an effect on intention to bike safely, self-efficacy has an effect on intention to bike safely, and the overall model is useful in explaining variance in children's intention to bike safely. The other hypotheses did not have enough evidence to support their postulations.

Discussion

Attitudes

The attitudes construct was divided into three factors: happy/safe, not afraid, and calm. Of these three factors, only the happy/safe factor had a positive direct effect on intention. The happy/safe and not afraid scales both tested to be reliable with Cronbach's alpha greater than 0.7. The calm scale was not reliable or acceptable with a Cronbach's alpha of less than 0.6.

Practical implications.

The individual contribution of each of these attitudes has practical implications for bicycle safety programs, specially the bike rodeo.

Anecdotally, when explaining the need for a helmet in a bicycle safety program, organizers like to present the negative consequences in a graphic way in order to scare the kids into wearing their helmets. According to this study, fear-related motivational tactics will not affect the children's intention to bike safely. In order to ameliorate these programs, organizers should try to use the happy/safe attitude as a motivator. Practical examples of this would be to have a helmet decorating station, allow children to have different clip or slide on decorations, or a paint-your-own-helmet station. Enforce happiness over skill development to a certain extent. If the children perceive their experiences of safety as a happy experience, they are more likely to intend to bike safely in the future. Organizers need to determine the goal of the program: is it to change behavior or is it to teach skills? If the answer is to change behavior, then attitudes are an important aspect to consider.

Subjective norms

Subjective norms were significant in predicting children's intentions to bike safely, $\beta=.382, p<.01$. This supports the listed hypothesis of subjective norms having a positive direct effect on intention. The subjective norm scale lent a Cronbach's alpha of .643, which is an acceptable amount of reliability. In the broader scope of literature, norms tend to be the weakest predictor of intentions (Armitage & Conner, 2001). The results of this study do not follow the trend in the general behavioral

literature. The importance of subjective norms has direct practical implications on bike rodeos and other bicycle safety programs.

Practical implications.

The normative importance poses the necessity of important people being involved in the rodeo. “Important people” means people who are important to the child, which very well may vary by culture and age. Specific examples of positive recommended changes are to first identify the important people, then use that information accordingly. If it is the parents, then make the rodeo at a time when parents could be involved. Make sure to advertise the program enough to where parents know to be involved. If the important people are older kids or older siblings, allow those older children to be rodeo rangers, modeling and encouraging the safety behavior on the younger children. If all of these options are procedurally or logistically impossible, allow children to participate in the rodeo as a group. For safety’s sake, children should practice the behavior and ride individually, but if children did the whole course as a group, they would create some normative experience through the process. Find and collaborate with the influential people and have a better behavioral change result.

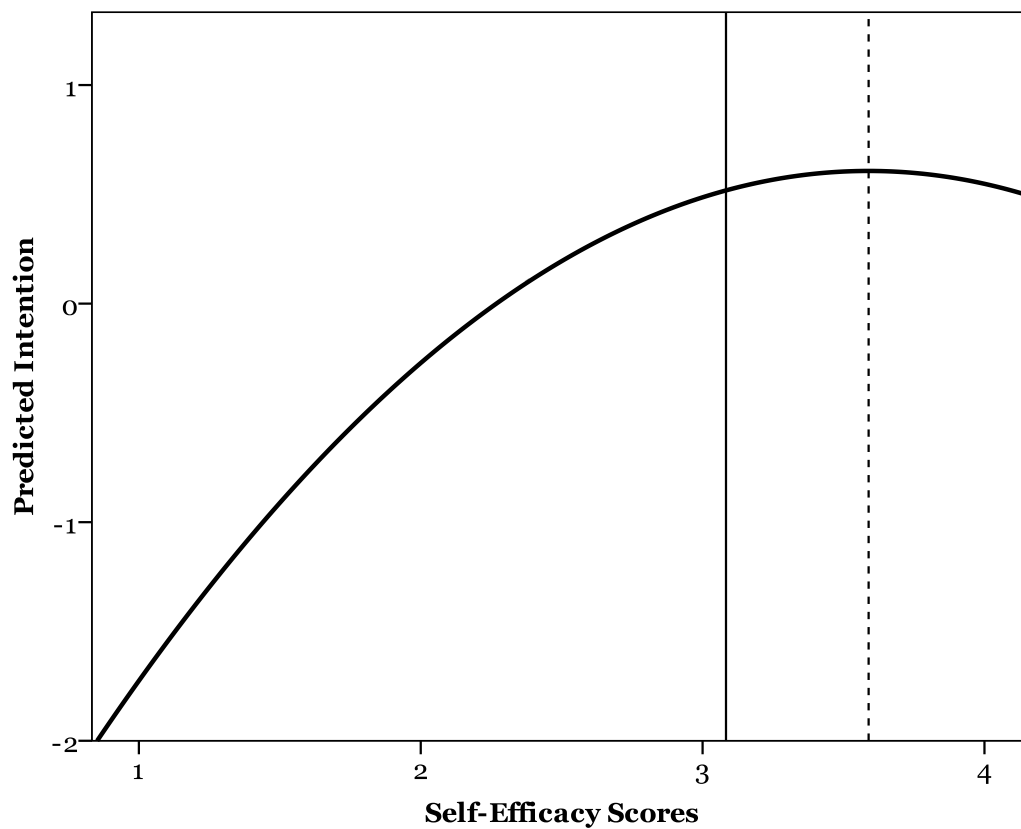
Self-efficacy

The self-efficacy/intention relationship has an overall positive trend (linear $\beta=.326$). The quadratic term revealed that for every one unit increase in self-efficacy, the slope of the relationship changes $-.269$

intention units. These two factors combined can be interpreted as: there is a positive slope between self-efficacy and intention until the curve peaks at a self-efficacy score of 3.589; after that, self-efficacy is negatively predictive of intention. This relationship is depicted in Figure 4. This result is counter-theoretical, so an investigation of possible causes of this eventual negative trend is discussed in Appendix D.

Figure 4.

Predicted slope of the self-efficacy-intention relationship.



Practical Implications.

Because this finding is counter-theoretical, caution is exercised in practical interpretation of these results. To be interpreted at face value, the

practical programmatic step would be to foster self-efficacy to a point, but high confidence in children's ability to bike safety leads to a lower intention to actually perform those behaviors. This interpretation should not be implemented until future studies add further investigation.

Bike Rodeo

Bike rodeo participation was not a significant predictor of intention to bike safely, partial $r^2=.010$, $p=.490$, which did not support the listed hypothesis. This could have been due to the nature of bike rodeos and the aim of the program. If the results of the self-efficacy analysis are accurate, and if bike rodeos tend to instill self-efficacy in children to the highest degree, that could be the reason that bike rodeos did not significantly predict intention.

Practical Implications.

Bike rodeos can be improved to better affect children's intentions to bike safely by using the constructs shown to strongly and significantly affect intention. Rodeos need to cater more to the happy/safe attitude as opposed to instilling fear in consequences of unsafe behavior. Rodeos can also more effectively harness the power of subjective norms in the process of the rodeo. Specific recommendations may be read in the earlier sections.

Full Model

The full model significantly predicts intention to bike safely, approximately 71% of the variance. This supports the last listed hypothesis.

Study significance

This study closes a gap by focusing on comprehensive bicycle safety behavior as opposed to just helmet use. Specifically, the behavioral prediction model explained 71% of children's intentions to bike safely. Equipped with this information, research can begin to focus on biking safely as a behavior encompassing more than helmet use. This study also offers practical programmatic ideas to better affect children's intentions to bike safely.

Recommendations

Procedural

Procedurally, data collection timing was the most difficult component. The study data were collected during the AIMS (Arizona Instrument to Measure Standards) testing season. If the data had not been collecting during the standardized testing season, the teachers may have been more willing and able to take their classroom to the computer lab to participate in the study, which would have lead to an increased sample size.

Secondly, although the IRB consent form has a fairly pre-existing structure, thought should be given on a better way to gain consent from the parents. Sending home the IRB consent form with a letter from the

school attached was not an effective method of achieving a great consent rate. Some of the comments concerning the form dealt with issues such as scary wording of the form, institutional verbiage, and sheer mass of information on one piece of paper. Sending a consent form home like that assumes that the parents are capable of reading the form, understanding the (small) risk their children could undergo during participation, and make a rational decision accordingly. This train of logic contains assumptions that may not hold true.

Possible recommendations could be to be able to talk to the parents at a PTO meeting before the consent form is disseminated. If parents could hear the researcher verbally explain the process, maybe they would be more perceptive. This PTO method still only reaches a select few. If the school sends out a weekly call to their parents, the researchers could come up with a 20-30 second blurb about their study, the parents possibly could be more prepared and perhaps more trusting of the process. Re-wording the IRB consent form is a possibility for future implementation, but there are limited allowable adjustments due to IRB guidelines.

Instruments

The online survey instrument had advantages and disadvantages. The advantages were the ability to create filters, so that respondents did not need to see irrelevant questions to them, the speed with which the data could be cleaned and analyzed, the speed with which the instrument could be disseminated, and the ease of collection organization. The main

disadvantage was the necessity of moving children and changing a weekly schedule to be able to access the survey. Although computer usage is very common in schools in current society, this use has not reached the optimum saturation level for online surveys to be most effective. It is much more efficient on the front end for a teacher to use an open 15 minutes to pass out and moderate the use of a paper survey than it is to take the 25 minutes to pack up the class, schedule computer lab time, take the class to the computer lab, bring them back to the classroom, and try to get students focused in the classroom again. Although the massive amount of paper tends to be an organizational headache on the back end, a larger sample size is likely more probably if the instrument can be completed in a regular classroom by all students at one time.

As far as the scales themselves within the instrument, it is preferable for all scales to have a Cronbach's alpha of over 0.7 (Nunnally, 1967). Further investigation as to the wording of the items should be done to determine if the children taking the survey and the researchers creating the survey are really interpreting each item in the same way.

Conceptual

Future research should embrace the utility of a behavior prediction model in explaining children's intentions to bike safely. Future research should also look into this self-efficacy intention relationship and its relationship with safety behaviors, specifically biking. Appendix D discusses the possible causes for the counter-theoretical relationship, and

future studies should further investigate those ideas. Future research should re-test the scale with another larger sample, and record and compare the findings. The wording of the items themselves should be investigated. Interviewing the students themselves and asking them to interpret the questions would be an effective, elucidating next step.

Since only the happy/safe attitude was a significant predictor, more studies should be done to determine what other attitudes surround children's intentions to perform safety behaviors. Attitudes might be specific to certain types of behaviors. Researchers should investigate the intricacies of attitude with intention to bike safely, so that future programs can be improved.

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APPENDIX A
SURVEY INSTRUMENT

Bicycle Safety Survey

Please read the following statements and click on the agree or disagree button to continue.

- I have been told that my parents (mom or dad) have said it's okay for me to take part in a survey about biking.

- The survey will take about 10-15 minutes to finish.

- The questions that ask about my background will be used only to describe the types of students completing this survey. The information will not be used to find out my name. No names will ever be reported.

- I am filling out this survey because I want to. I know that I can stop at any time if I want to, and it will be okay if I want to stop.

If you want to participate in the survey and agree with the statements above, press the agree button. If you do not want to participate in the survey, press the disagree button.

Agree

Disagree

How old are you today?

- 7 years old
- 8 years old
- 9 years old
- 10 years old

- 11 years old
- 12 years old
- 13 years old
- 14 years old

What grade are you in?

- 3rd grade
- 4th grade
- 5th grade

- 6th grade
- 7th grade
- 8th grade

Are you a _____?

Boy

Girl

What is your ethnicity? (Select one or more responses.)

- White
- Black or African-American
- Asian
- Latino(a), Hispanic, Mexican, or Spanish
- American Indian or Alaska Native
- Other (what is it?)

To what extent are each of the following important or not important to you? (Select one response for each row.)

	Not at all important	A little important	Very important
Friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Parents/guardians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Teachers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other adults	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Have you ever ridden a bike?

- Yes
- No

How many Bike Rodeos have you been to?

- 0
- 1
- 2
- 3
- 4
- 5 or more

The next questions ask you about biking safety. Please answer each to the best of your ability.

Bicycle riders should always wear helmets.

- True
- False

Bicycle riders should always fasten their helmet straps when they are riding a bike.

- True
- False

Bicycle riders should ride their bike facing traffic, so they can see what's coming.

- True
- False

Bicycle riders must stop at all stop signs.

- True
- False

Bicycle riders must give hand signals before making a turn.

- True
- False

Bicycle riders should always wear bright colors when they're riding their bike during the day.

- True
- False

The next questions ask you about how you feel when you ride a bike.

Riding a bike in a safe manner means riding on the street if you are over 10 years old, riding on the right hand side of the road, and not playing around when biking in the streets.

Agreement survey software
 To what extent do you feel the following when you are biking in safe manner?

	Not at all	A little	Very much
Happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

To what extent do you feel the following when you wear your helmet when riding a bike?

	Not at all	A little	Very much
Safe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The next questions ask you about your thoughts before you ride a bike.

Before you ride a bike, how often do you intend to wear your helmet?

Never	Some of the time	Most of the time	All the time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Before you ride a bike, how often do you intend to wear bright or reflective clothing?

Never	Some of the time	Most of the time	All the time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Before you ride a bike, how often do you intend to obey traffic signs and signals?

Never	Some of the time	Most of the time	All the time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Before you ride a bike, how often do you intend to ride your bike in a safe manner?

Never	Some of the time	Most of the time	All the time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The next questions ask you about how sure you are when riding a bike.

How often can you bike in a safe manner?

Never	Some of the time	Most of the time	All the time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How often can you wear bright or reflective clothing when you ride a bike?

Never	Some of the time	Most of the time	All the time
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How often can you wear a helmet when you ride a bike?

Never Some of the time Most of the time All the time

How often can you obey traffic signals when you ride a bike?

Never Some of the time Most of the time All the time

The next questions ask you about thoughts about important people in your life, such as your parents, friends, teachers, and other adults.

How often do important people in your life think you should wear a helmet when you ride a bike?

Never Some of the time Most of the time All the time

How often do important people in your life think you should wear bright or reflective clothing when you ride a bike?

Never Some of the time Most of the time All the time

How often do important people in your life think you should obey traffic signs and signals when you ride a bike?

Never Some of the time Most of the time All the time

How often do important people in your life think you should ride your bike in a safe manner?

Never Some of the time Most of the time All the time

Thank you for participating in the survey!

Please let your teacher know that you have finished the survey.

APPENDIX B
IRB APPROVAL FORM



To: Ariel Rodriguez

for **From:** Mark Roosa, Chair *sm*
Soc Beh IRB

Date: 02/19/2010

Committee Action: Expedited Approval

Approval Date: 02/19/2010

Review Type: Expedited F7

IRB Protocol #: 1002004834

Study Title: AZ Safe Routes to School

Expiration Date: 02/18/2011

The above-referenced protocol was approved following expedited review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date. You may not continue any research activity beyond the expiration date without approval by the Institutional Review Board.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Soc Beh IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Soc Beh IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

ARIZONA SAFE ROUTES TO SCHOOL

PARENTAL LETTER OF PERMISSION

Dear Parent:

I am a professor in the School of Community Resources and Development at Arizona State University. I am conducting a research study to better understand student walking and biking safety behavior.

I am inviting your child's participation, which will involve completing an online survey at school which will take approximately 15-20 minutes to complete. Your child's participation in this study is voluntary. If you choose not to have your child participate or to withdraw your child from the study at any time, there will be no penalty to you or your child (for example, it will not affect your child's grade, treatment/care in school, etc). Likewise, if your child chooses not to participate or to withdraw from the study at any time, there will be no penalty. The results of the research study may be published, but your child's name will not be used.

Although there may be no direct benefit to your child, the possible benefit of your child's participation is we will learn more about how to help children behave in a safer manner when they walk or bike outdoors. There are no foreseeable risks or discomforts to your child's participation.

Any information that is collected from your child will be confidential. Only the researcher and his research team will have access to the information. Additionally, we will not have access to any information that will allow us to connect your child's name to the information they provide. The results of this study may be used in reports, presentations, or publications, but your child's name will not be known. Results will only be shared in the aggregate form.

If you have any questions concerning the research study or your child's participation in this study, please call me at (602) 496-1057.

Sincerely,

Ariel Rodriguez, Ph.D.

By signing below, you are giving consent for your child _____ (Child's name) to participate in the above study.

Signature Printed Name Date

If you have any questions about you or your child's rights as a subject/participant in this research, or if you feel you or your child have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the Office of Research Integrity and Assurance, at (480) 965-6788.

ASU IRB
Approved
Sign SM
Date 2/9/10-4871

Where are you taking this survey?

Home

School

**Web Design Note: Home option selection response: You can only proceed with this survey at school. You will not be able to continue.

School option selection takes students to student assent form page below.**

Arizona Safe Routes to School

Please read the following statements and click on the agree or disagree button to continue.

- I have been told that my parents (mom or dad) have said it's okay for me to take part in a survey about walking and biking to school.
- The survey will take about 15-20 minutes to finish.
- The questions that ask about your background will be used only to describe the types of students completing this survey. The information will not be used to find out your name. No names will ever be reported.
- I am filling out the survey because I want to. I know that I can stop at any time if I want to and it will be okay if I want to stop.

If you want to participate in the survey and agree with the statements above, press the agree button. If you do not want to participate in the survey, press the disagree button.

<<Agree Button>>

<<Disagree Button>>

	ASU IRB
	Approved
Sign	Sm
Date	2/9/19 2:18

Where are you taking this survey?

Home

School

**Web Design Note: Home option selection response: You can only proceed with this survey at school. You will not be able to continue.

School option selection takes students to student assent form page below.**

Arizona Safe Routes to School

Please read the following statements and click on the agree or disagree button to continue.

- I have been told that my parents (mom or dad) have said it's okay for me to take part in a survey about walking and biking to school.
- The survey will take about 15-20 minutes to finish.
- The questions that ask about your background will be used only to describe the types of students completing this survey. The information will not be used to find out your name. No names will ever be reported.
- I am filling out the survey because I want to. I know that I can stop at any time if I want to and it will be okay if I want to stop.

If you want to participate in the survey and agree with the statements above, press the agree button. If you do not want to participate in the survey, press the disagree button.

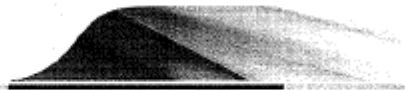
<<Agree Button>>

<<Disagree Button>>

ASU IRB Approved	
Sign	<u>sm</u>
Date	<u>6/9/10 7/1/11</u>

APPENDIX C

IRB APPROVED MODIFIED CONSENT FORM



To: Ariel Rodriguez

for From: Mark Roosa, Chair SM
Soc Beh IRB

Date: 12/10/2010

Committee Action: Amendment to Approved Protocol

Approval Date: 12/10/2010

Review Type: Expedited F12

IRB Protocol #: 1002004834

Study Title: AZ Safe Routes to School

Expiration Date: 02/18/2011

The amendment to the above-referenced protocol has been APPROVED following Expedited Review by the Institutional Review Board. This approval does not replace any departmental or other approvals that may be required. It is the Principal Investigator's responsibility to obtain review and continued approval of ongoing research before the expiration noted above. Please allow sufficient time for reapproval. Research activity of any sort may not continue beyond the expiration date without committee approval. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol on the expiration date. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study termination.

This approval by the Soc Beh IRB does not replace or supersede any departmental or oversight committee review that may be required by institutional policy.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Soc Beh IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Soc Beh IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

Arizona State University
Office of Research Integrity and
Assurance
IRB
P.O. Box 871103
Tempe, AZ 85287-1103
Phone: 480-865-6788
Fax: (480) 965-7772




For Office Use Only:
Date Received:



Modification Form Institutional Review Board (IRB)

INVESTIGATOR INFORMATION		
PROTOCOL TITLE: AZ Safe Routes to School	HS # 1002.004824 A001	
PRINCIPAL INVESTIGATOR: Ariel Rodriguez, Ph.D.	DEPARTMENT/ CENTER: School of Community Resources and Development	
CAMPUS ADDRESS: 411 N. Central Ave., Suite 550; Mail Code 4020; Phoenix, AZ 85004	PHONE: 602-496-1057	
CO-INVESTIGATORS: Kayla Payton	EMAIL: ariel.rodriguez@asu.edu	
FUNDING STATUS: If project is funded or funding is being sought, provide list of all sponsors and grant numbers: Sponsor: Regional Public Transportation Authority, dba Valley Metro; Grant #: Regional Safe Routes to School Center Project (NO. 10-025698) and Regional Bicycle & Pedestrian Safety Education Program (NO. 10-025699); ASU account #: RXS 0129 and RXS 0130		
TYPE OF MODIFICATION (CHECK ALL THAT APPLY)		
Please attach any revised documents (forms, scripts, etc). Attach a brief summary of the proposed changes as well as a justification.		
<input checked="" type="checkbox"/>	New Procedures	Attach a description of the new procedures and a revised consent form. In addition to the children survey, parents will now be asked to participate in a study of their own to better understand from their perspective the challenges to improving walking and biking safety for their child. The instrument that will be used is based on the instrument used at the national level by Safe Routes to School programs throughout the country. The national instrument is standardized and focuses on collecting information from parents/guardians of children who are in schools that implement Safe Routes to School. Our instrument is almost identical to the national survey (as it will feed into the national data) with slight item question modifications to reflect the online collection nature of this study (compared to paper survey method used at the national level) and the addition of one item: the race/ethnicity of their child. The instrument and revised consent form are attached.
<input type="checkbox"/>	Study Title Change	What is the new title?
<input type="checkbox"/>	Change in Study Personnel	<input type="checkbox"/> Add (include the name, role, and contact information. Include copies of training certificates: http://researchintegrity.asu.edu/training/humans <input type="checkbox"/> Delete
<input type="checkbox"/>	Change of Site	<input type="checkbox"/> Add (include the name and location. If this changes the enrollment, that should be noted below.) <input type="checkbox"/> Modify <input type="checkbox"/> Delete
<input type="checkbox"/>	Change in Enrollment	Attach a narrative justifying the change. If this will affect the consent, send a revised consent form as well.
<input checked="" type="checkbox"/>	Consent Change	Attach a copy and describe the change(s). The parent consent form has been modified to reflect our asking the

Revision 05/09

		parents to participate independently in a survey of their own as well as allowing their child to participate in the study.
<input type="checkbox"/>	Advertisement	Attach copies of the advertisement or announcement.
<input checked="" type="checkbox"/>	Instruments (surveys, questionnaires, interviews, etc)	Attach copies of the proposed instruments and describe any changes from the approved protocol. If you are adding or deleting any instruments or items to an instrument, describe what the changes are and submit the revised materials. The initial child instrument was too long, thus two separate surveys will be used in lieu of the longer survey. However, both surveys are composed of questions already reviewed by ASU IRB in the longer survey. The first survey will remove a number of constructs of study for both walking and biking safety. The second survey will include all original study constructs, but focus solely on bike safety. Both surveys have been attached. Given that the surveys are online, filters were used to combine the surveys for 3-5 and 6-8 graders.
<input type="checkbox"/>	Other	Describe the changes. If this affects the consent process, submit a revised consent form.
SIGNATURE:		
PRINCIPAL INVESTIGATOR:		Name (first, middle, last): Ariel Rodriguez
		Signature:  Date: December 9, 2010

ASU IRB
Approved

Signature: 

Date: 12/10/10

**ARIZONA SAFE ROUTES TO SCHOOL
PARENT/GUARDIAN LETTER OF PERMISSION**

Dear Parent/Guardian:

I am a professor in the School of Community Resources and Development at Arizona State University, and I am conducting a research study to better understand student walking and biking safety behavior.

I am inviting both you and your child to participate in separate studies. For your participation, you are being invited to participate in an online study which will last approximately 10 minutes. For your child, I am inviting them to complete two separate online surveys at their school which will take approximately 15-20 minutes to complete.

Both your participation and your child's participation in this study are voluntary. If either of you choose not to participate or to withdraw from the study at any time, there will be no penalty to either of you (for example, it will not affect your child's grade, treatment/care in school, etc). Likewise, if you choose to not allow your child to participate or withdraw them from the study at any time, there will be no penalty to either of you. The results of the research study may be published, but neither your name nor your child's name will be used.

Although there may be no direct benefit to you or your child, the possible benefit of you and your child's participation is we will learn more about how to help children behave in a safer manner when they walk or bike outdoors. There are no foreseeable risks or discomforts to either of you.

Any information that is collected from you and your child will be confidential. Only the researcher and his research team will have access to the information. Additionally, we will not have access to any information that will allow us to connect either you or your child's name to the information provided. The results of this study may be used in reports, presentations, or publications, but you and your child's name will not be known. Results will only be shared in the aggregate form.

If you have any questions concerning the research study, your participation or your child's participation in this study, please contact me at (602) 496-1057 or ariel.rodriguez@asu.edu.

Sincerely,

Ariel Rodriguez, Ph.D.

To participate in the parent/guardian study, please visit the following website below. Completion of the online survey will be considered your consent to participate:

<<Weblink here: English Version>>

By signing below, you are giving consent for your child _____ (Child's name) to participate in the above mentioned study. Please place this signed letter in your child's folder to be returned to their teacher.

Signature Printed Name Date

If you have any questions about you or your child's rights as a subject/participant in this research, or if you feel you or your child have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the Office of Research Integrity and Assurance, at (480) 965-6788.

ASU IRB Approved
Sign <u>JTF for Mark Roosa</u>
Date <u>12/10/10</u> — <u>02/18/11</u>

APPENDIX D
SELF-EFFICACY INVESTIGATION

Several avenues were explored in the pursuit of explaining the counter-theoretical nature of self-efficacy in the model. These avenues were outlier analysis, correlations between items, and items as individual predictors.

Outlier Analysis

Case-wise diagnostics were run to find any data outside of 3 standard deviations, and none were found. There was one individual outside of two standard deviations. That item was removed and a regression analysis was conducted again, and the standardized regression coefficient for the quadratic relationship of self-efficacy to intention remained negative. Outliers are not an acceptable explanation of this counter-theoretical nature.

Correlation between Items

The items concerning obeying traffic signs and signals and helmet use are the only items significantly correlated with intention. All items are significantly correlated with the helmet use item. The safe manner item is only significantly correlated with helmet use. Correlations between items can be seen in Table 5. Significant correlations have been flagged. These correlations do not completely explain the nature of the self-efficacy construct, but in combination with other factors, they might lend some explanation.

Table 5

Spearman Correlations Between Efficacy Items

Measure	Clothing	Traffic	Helmet	Intention
Safe Manner	.110	.098	.317*	.382
Clothing		.306*	.331**	.214
Traffic			.439**	.424**
Helmet				.387**

** Correlations significant at the .01 level (2-tailed)
* Correlations significant at the .05 level (2-tailed)

Items as Individual Predictors

The self-efficacy items reported as individual predictors of intention are reported in Table 6. The terms that tend to be driving the construct as a whole are the safe manner quadratic term ($\beta = -.300$, $p = .015$) and the linear ($\beta = -.163$, $p = .072$) and quadratic clothing ($\beta = .224$, $p = .096$) terms. These terms may explain the negative nature of the self-efficacy curve. The extent or specific nature of the influence of these terms on the curve is all of speculation because it is not explained theoretically. This opens the door for future research to examine this concept more critically: the items, the analysis, the sample. The next consideration would be an analysis of the items and an interview with some children to see if the children understand the question in the same frame that the researcher intends for them to understand it.

Table 6

Summary of Multiple Regression Analysis of Individual Centered Self-Efficacy Items and Quadratic Item Terms on Intentions to Bike Safely (N=56)

Regressors and Items	B	SE(B)	β	Partial r^2	t	Sig.(p)	VIF
(Constant)	.716	.681			1.053	.299	
Happy/Safe	.356	.160	.227	.107	2.219	.032	2.060
Not Afraid	.009	.130	.006	.000	.067	.947	1.435
Calm	-.008	.135	-.005	.000	-.056	.956	1.421
Norm	.471	.138	.354	.220	3.400	.002	2.141
Bike Rodeos	-.157	.146	.093	.028	1.080	.286	1.449
How often can you bike in a safe manner?	.038	.124	.037	.002	.310	.758	2.806
(How often can you bike in a safe manner?) ²	-.399	.158	-.300	.135	-2.526	.015	2.791
How often can you wear bright or reflective clothing when you ride a bike?	-.059	.072	-.080	.016	-.812	.422	1.903
(How often can you wear bright or reflective clothing when you ride a bike?) ²	-.130	.070	-.163	.077	-1.849	.072	1.537
How often can you wear a helmet when you ride a bike?	.154	.090	.224	.066	1.706	.096	3.417
(How often can you wear a helmet when you ride a bike?) ²	.055	.080	.087	.011	.686	.497	3.164
How often can you obey traffic signals when you ride a bike?	.071	.137	.090	.007	.520	.606	5.924
(How often can you obey traffic signals when you ride a bike?) ²	-.071	.092	-.139	.014	-.775	.443	6.322

Note: $R^2=.792$, Adjusted $R^2=.727$, $F(13,54)=12.045$, $p<.01$

APPENDIX E
EXCLUDED REGRESSORS

A regression equation was explored that included ethnicity, gender, age and grade. These items did not explain any additional variance of intention to bike safely beyond the other predictors, and even the lack of prediction was insignificant. Due to their poor predictive ability, demographic variables were left out of the final model. The coefficients and significance levels are recorded in Table 7.

Table 7

Summary of Multiple Regression Analysis of Mean Predictors on Intentions to Bike Safely (N=57)

Variable	B	SE(B)	β	Partial r^2	t	Sig.(p)
(Constant)	.446	.754			.591	.558
Happy/Safe	.353	.164	.223	.095	2.147	.037
Not Afraid	.081	.129	.053	.009	.631	.531
Calm	-.108	.145	-.067	.013	-.746	.460
Norm	.490	.124	.376	.262	3.959	.000
Self-Efficacy	.365	.119	.336	.177	3.077	.004
Bike Rodeos	.101	.132	.059	.013	.764	.449
Self-Efficacy ²	-.351	.126	-.272	.150	-2.783	.008
Ethnicity	-.015	.134	-.008	.000	-.110	.913
Gender	.024	.134	.014	.000	.175	.862
Age	.010	.128	.015	.000	.076	.940
Grade	.005	.149	.007	.000	.036	.971

Interaction terms of bike rodeo participation with all other sustained predictors were analyzed. The results can be seen in Table 8.

None of the interaction terms were significant nor did they lend any

explanation of the variance over 2% to the final model. Due to these reasons, these variables were excluded.

Table 8

Summary of Multiple Regression Analysis of Bike Rodeo Interaction Terms on Intentions to Bike Safely (N=57)

Variable	B	SE(B)	β	Partial r^2	t	Sig.(p)
(Constant)	.593	1.424			.417	.679
Happy/Safe	.430	.321	.272	.039	1.340	.187
Not Afraid	.160	.263	.104	.008	.609	.546
Calm	-.300	.328	-.186	.018	-.913	.366
Norm	.495	.286	.379	.064	1.731	.091
Self-Efficacy	.351	.223	.325	.053	1.574	.123
Bike Rodeos	-.143	1.407	-.084	.000	-.102	.919
Self-Efficacy ²	-.322	.134	-.249	.117	-2.396	.021
Happy/Safe * Rodeo	-.092	.363	-.143	.001	-.252	.802
Not Afraid * Rodeo	-.115	.300	-.190	.003	-.381	.705
Calm * Rodeo	.256	.372	.409	.011	.688	.495
Self-Efficacy * Rodeo	.024	.247	.047	.000	.096	.924
Norm * Rodeo	.003	.316	.006	.000	.009	.993

APPENDIX F
ANALYSIS WITHOUT PILOT STUDY

A multiple regression analysis was conducted on two groups of data, one of just the pilot study and one of the sample, Tables 4 and 5. The same predictors were significant in both models, and the models had similar significant strength to them. Based on these observations, all observations were used in the analyses in the body of the paper.

Table 9

Summary of Multiple Regression Analysis of Mean Predictors on Intentions to Bike Safety for the Sample

Variable	B	SE(B)	β	t	Sig.(p)	VIF
(Constant)	.105	.775		.135	.893	
Happy/Safe	.410	.146	.282	2.797	.007	1.271
Not Afraid	.054	.127	.041	.426	.672	1.162
Calm	-.049	.165	-.030	-.296	.768	1.265
Norm	.548	.126	.449	4.335	.000	1.341
Self-Efficacy	.158	.127	.148	1.243	.220	1.764
Bike Rodeos	-.004	.144	-.003	-.028	.978	1.089
Self-Efficacy ²	-.290	.150	.148	-1.937	.059	1.548

Note: $R^2=.623$, Adjusted $R^2=.567$, $F(7,54)=11.112$, $p<.01$

Table 10

Summary of Multiple Regression Analysis of Mean Predictors on Intentions to Bike Safety for the Pilot Study

Variable	B	SE(B)	β	t	Sig.(p)	VIF
(Constant)	-.010	.772		-.014	.989	
Happy/Safe	.102	.278	.066	.367	.717	4.786
Not Afraid	.213	.210	.090	1.013	.323	1.175
Calm	.117	.197	.078	.590	.562	2.590
Norm	.547	.177	.406	3.088	.006	2.568
Self-Efficacy	.460	.153	.451	3.012	.007	3.336
Bike Rodeos	-.039	.165	-.020	-.235	.816	1.123
Self-Efficacy ²	-.190	.126	-.216	-1.506	.148	3.055

Note: $R^2=.866$, Adjusted $R^2=.819$, $F(7,27)=18.406$, $p<.01$