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Development of a supplementary driver education tool for teenage drivers on rural roads

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ABSTRACT

Introduction: Teenagers are at greater risk than any other drivers on the highway system in the United States, especially in states like Texas with large rural road networks. Rural roads present many unique safety concerns that are traditionally unexplored in standard driver education curricula. In fact, many studies have actually indicated that driver education is very limited in use and efficacy. However, national goals for driver education envision a more comprehensive continuing education process, and computer-based education tools may be one supplementary method to address gaps in young driver training. *Methods:* The research team developed a flash-based computer education tool covering topics relating to driver behavior and rural roads and tested the efficacy of this tool in two rural-serving high schools in West Texas by comparing the results of pre- and post-intervention surveys using linear regression, analysis of variance, and logistic regression. *Results:* The results were promising, with students who used the intervention scoring higher on both a driver behavior scale and rural safety scale. All models indicated that students who took the intervention, even without being previously licensed, demonstrated greater knowledge and awareness. *Conclusions:* The models demonstrated the viability of this type of intervention tool for inclusion in a phased driver education program and for addressing the lack of rural road safety knowledge. *Practical applications:* The computer-based-training program developed in this project supports the potential efficacy of supplemental pre-licensure computer-based education tools for improving teen driver knowledge and safety awareness and fills a gap for rural road safety education.

1. Introduction

Crashes with teen drivers are a major concern in the United States. Teens are at greater risk than other age brackets for being killed in crashes, and crashes are the leading cause of deaths for teens in the United States (Thomas et al., 2012). This problem is often made even more severe in states with large rural road networks due to the hazardous and demanding natures of rural driving conditions. Rural roads commonly have unique hazards that include different geometric and access properties from urban roads (Karlaftis and Golias, 2002; Cafiso et al., 2010), increased speed limits (Theofilatos and Yannis, 2014), less cover against adverse weather (Theofilatos and Yannis, 2014), an increased association with driver alcohol use (Chen et al., 2009; Jiang et al., 2008), longer trip lengths (Chen et al., 2009), less enforcement and use of safety devices (Peek-Asa et al., 2010), underage driving in farm communities (Frisch and Plessinger, 2007), and more (National Highway Traffic Safety Administration, 1996). Texas is one of many states that faces significant burden from rural road danger due to its substantial rural network; in 2014, more fatal crashes occurred on rural roads than on urban roads, and the rate at which these crashes occurred was significantly more problematic due to the lower mileage on the rural road network (Texas Department of Transportation, 2015; Office of Highway Policy Information, 2014). The large number of fatal rural crashes is one of the reasons Texas often leads the nation in number of fatal crashes per year (National Highway Traffic Safety Administration, 2014).

An endemic issue that also contributes to the high number of traffic fatalities in Texas is the large population of young drivers (Texas Department of Transportation, 2015). Teen and beginning drivers have been consistently shown to be at greater risk for crashing than drivers in other age groups (Brijs et al., 2014; Scott-Parker et al., 2014; Thomas et al., 2012; Morrisey and Grabowski, 2006; The Association of National Stakeholders in Traffic Safety Education, 2007; Ramirez et al., 2013). There are a number of reasons for this, including a disconnection between habits and skills due to skills overassessment (Petzoldt et al.,

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2013; Lonero and Mayhew, 2010; Young Driver Research Initiative Research Team, 2007), forgetfulness of road rules due to limitations of standard education practices (Li and Tay, 2014; Scott-Parker et al., 2014; Major, 2015), and carelessness and recklessness, especially when engaging in more than one risky behavior (Brijs et al., 2014; Phillips and Sagberg, 2013; Carlos et al., 2009). Although teen driver risk tapers off over time, it is still important to address these safety concerns while drivers are young (Ouimet et al., 2014; Isler et al., 2009).

In the United States, driver education has been a common practice used to attempt to reduce the number of traffic crashes involving teens, but the efficacy of driver education has been widely debated. Few studies have shown statistically significant reductions in crashes, and those that have reported marginal gains are contentious. Numerous meta-analyses have been conducted regarding historical investigations into driver education, and these meta-analyses have typically shown that driver education itself does not adequately transfer skills or that the studies supporting driver education have been poorly constructed (Mayhew and Simpson, 1996; Ker et al., 2005; Thomas et al., 2012; Chaudhary et al., 2011; Lonero and Mayhew, 2010). The reasons that have been put forth for the inefficacy of driver education are numerous and include: lack of skills transferred into habits (Lonero and Mayhew, 2010), inexperience and immaturity (Lonero and Mayhew, 2010), lack of focus on attitudes (Lonero and Mayhew, 2010), limited time for training (The Association of National Stakeholders in Traffic Safety Education, 2007), and allowing teens to receive licenses earlier (Chaudhary et al., 2011), among others. For these reasons, driver education is simply thought to just not work.

However, it is important to bear in mind that driver education programs may vary and that driver education itself does have certain strengths, including integration with graduated driver license (GDL) programs to more thoroughly impart safe driving skills to build habits (Highway Safety Center, 2002; Morrisey and Grabowski, 2006) and reinforcement of key driving knowledge before and after licensure (American Driver and Traffic Safety Education Association Curriculum and Standards Committee, 2012; Li and Tay, 2014; Brijs et al., 2014; Lonero and Mayhew, 2010). Importantly, these strengths integrate with the vision of driver education in the United States. Government support of continued driver education is strong, although the National Highway Traffic Safety Administration (NHTSA), the Association of National Stakeholders in Traffic Safety Education (ANSTSE), the American Driver and Traffic Safety Education Association (ADTSEA), and other entities all advocate for reform of driver education. New standards have been proposed by ADSTEA (Chaudhary et al., 2011) and ANSTSE (The Association of National Stakeholders in Traffic Safety Education, 2007) to increase the requirements of driver education in all states to include a 45-h classroom program. This program will ideally include more active learning and make use of interactive tools to better convey the skills necessary to build good habits. Simulations and computer programs have been demonstrated to be effective for improving education when young drivers engage in computer-based training (CBT) because these materials are more engaging than standard education classes and documents (Highway Safety Center, 2002; Lonero and Mayhew, 2010; The Association of National Stakeholders in Traffic Safety Education, 2007; Petzoldt et al., 2013). Moreover, CBT programs allow for increased interaction and reward good behavior, enforcing good habits. Education programs designed to be similar to games have proven especially effective (Thomas et al., 2012; Li and Tay, 2014; Major, 2015). A broader vision of driver education in the United States, as envisioned by the government entities, involves driver education being used as a phased program that integrates with GDL programs to impart critical knowledge and skills to drivers before, during, and after licensure (The Association of National Stakeholders in Traffic Safety Education, 2007) in order to make it cooperative and comprehensive (Highway Safety Center, 2002; Thomas et al., 2012; Lonero and Mayhew, 2010). This type of cycle of education is critical because research has also shown that simple, one-time training programs are less effective than shorter, mass training exercises (de Crean and Vlakveld, 2013; Thomas et al., 2012). Texas specifically fails to meet these newest standards for driver education, both trailing in recommended instruction time and lacking more interactive materials (Chaudhary et al., 2011; Highway Safety Center).

In order to address the lack of appropriate training regarding rural roads and to test a potential supplementary program to be used in conjunction with standard driver education practices, the research team conducted a project on behalf of the Texas Department of Transportation wherein teen driver perceptions and behaviors were measured before and after using a CBT education tool. Students from eleventh and twelfth grade with ages ranging from 15 to 19 from two different high schools in rural communities outside of the city form the sample for this study. The intervention development is only the first phase of a series of projects investigating how to improve driver education for rural teens, and future work will focus on parental involvement and transfer of knowledge in order to provide a more dedicated, long-term education system that overcomes the shortcomings of temporary driver education. The purpose of this paper is to highlight the potential efficacy of a CBT program for pre-licensure training and to validate the use of that program with a statistical before-and-after comparison.

2. Material and methods

In order to address the known shortcoming of driver education regarding rural roads for teenagers, the research team proposed a multi-tier project to (1) gather data regarding how teens view rural roads and driving behaviors, (2) use that data to develop an interactive CBT program to address the knowledge shortcomings identified in the literature and from the data gathered from the teens, (3) test that program as an intervention, (4) gauge the efficacy of the program, and (5) modify the program and distribute it to other rural communities. The ultimate goal of this project is to freely provide an interactive online CBT program that teens in rural areas all across the United States can access to learn about rural roads and safe driving. This program fits into the vision for a more comprehensive, phased education program that provides pre- and post-licensure education and fills the gap regarding rural roads. The initial region for development of this program is Lubbock County and the surrounding counties in West Texas. A discussion of the statistical analysis methods used follows a detailed discussion of the intervention tool in this section.

2.1. Intervention tool

The intervention tool used in this project was a computer-based interactive program that used flash simulations to highlight hazardous situations or behaviors before asking questions. The tool is similar to other CBT packages, including Driver-ZED (Blank and McCord, 1998), CD-Drives (Cockerton and Isler, 2003; Isler and Cockerton, 2003), RAPT-3 (Pradhan et al., 2009), and more (Petzoldt et al., 2013; Weiß et al., 2013), yet it is sufficiently different to provide a new contribution to the growing body of literature regarding CBT. First, unlike photo-realistic programs like Driver-ZED (Blank and McCord, 1998), CD-Drives (Cockerton and Isler, 2003), and the CBT tools developed by Petzoldt et al. (2013) and Weiß et al. (2013), the education tool developed in this study uses less realistic animations. Although photorealism was avoided par-