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Effectiveness of an Emergency Vehicle Operations Course Component, Visual and Perceptual Skills: Analyzing Student Response to Searching, Identifying, Predicting, Deciding, and Executing Skills

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DEDICATION

I dedicate this work to my

Family.

Thank you for all of your help and inspiration.

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ABSTRACT

As funding for driver education declines according to the National Highway Safety Administration (NHSA) *2013 Traffic Safety Facts,* there were 2,345,719 people injured or killed as a result of vehicle crashes. NHTSA reported that there were a total of 118 people killed in 2013 from accidents involving emergency vehicles. The effectiveness of an Emergency Vehicle Operations Course component of visual and perceptual skills can be measured by administering the Driver Performance Test prior to and after student participation. This study examined the population of the students who participated in the TRS 235: Emergency Vehicle Operations Course at Eastern Kentucky University (EKU) in a traditional classroom and online delivery formats. This study determined the potential for a participant to be involved in a crash prior to and after completing TRS 235, as well as the effect the course had on the participants' visual and perceptual skills. The results of this study indicated that the online and traditional course delivery formats pre and post-test total scores increased significantly. This study also determined that there was a significant difference between the efficacy of online and traditional delivery with online participants scoring higher than the traditional participants. It is important to note that this study does not examine the actual physical performance of the participants' driving skills or behavior.

Keywords: skill enhancement, driver education, driver control sequence, SIPDE, search, identify, predict, decide, execute, SEE, evaluate, pitch, yaw, roll, oversteer, understeer, traction loss, visual and perceptual skills, driver performance test, traditional vs online delivery methods, traffic safety, emergency vehicle operations, TRS 235.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The majority of Americans travel on a daily basis. Whether we walk, bike, drive, or take public transportation; we encounter vehicles on a daily bases. This exposure to vehicles makes the chances of being involved in a collision so great that every American has been involved in a collision or knows someone who has been directly involved in a collision. Who do we call when a collision occurs? We call emergency services, police, fire, EMS. Who does emergency services call when they are involved in a collision? Well they call themselves. The goal of training is to minimize risk and maximize efficiency and safety.

This study was designed to evaluate the effects of an emergency and defensive driving course on the students' visual and perceptual skills. The course, TRS 235: Emergency Vehicle Roadway Operational Safety was offered at Eastern Kentucky University in two formats. The first format was offered on-campus every spring semester. The second format was offered online every fall semester. Regardless of the format offered, the courses were composed of the same objectives. TRS 235 was a full sixteen week course. The students were required to complete the same Driver Performance Test (DPT) at the beginning of the class and as part of the final. Both the online and on campus classes were administered the DPT in the same format. TRS 235 was composed of three main components which include emergency and defensive operation, learning environment and technology. Although the course was not designed to measure or instruct individual visual and perceptual skills, each of the course components included one or more of those skills.

Background

The basis of this study was based upon the Driver Performance Test II (DPT), developed by the late Jack Weaver Ph.D. The DPT has been proven to be a valid way of measuring a driver's visual and perceptual skills. The DPT determines the rate at which the participant will become involved in a crash. The test also determines where the student's strengths and weaknesses are in the Search, Identify, Predict, Decide, and Execute (SIPDE) process. As part the DPT, Weaver developed the test/crash frequency cart found in Appendix E. Weaver's research was "based on eight thousand randomly selected experienced automobile and light truck drivers with a mean annual driving exposure of 15,000 miles" (Weaver, 1996). The DPT is based on the visual and perceptual skills of SIPDE. Weaver's study makes it clear that the scale did not correlate with the National Safety Council (NSC) or the United States Department of Transportation (DOT). Weaver reported that a lack of correlation between the Department of Transportation and the National Safety Council and Weaver's DPT competency scale results from "all crashes regardless of fault, extent of injuries, or value of property damage, are included in the crash frequency rates" (Weaver, 1996). The Driver Control Sequence's foundation is the visual and mental skills that influence motion and steering skills required to successfully drive a motor vehicle.

Statement of the Problem

The National Highway Traffic Safety Administration (NHTSA) *Traffic Safety Facts 2013 Report* states there were 2,345,719 people killed or injured resulting from vehicle collisions. Of the 2,345,719 people killed or injured 118 resulted from collisions involving emergency vehicle. The Emergency Vehicle Operations Course (TRS 235) was designed to improve a student's ability to safely drive a motor vehicle in the fire protection industry. This study was not to be construed in a way to evaluate the course itself, such as evaluating the physical performance of the participants' driving skills or behavior. TRS 235 students were graded using a method of university / college evaluations. University or college evaluations were designed to measure students' understanding of course components included basic operation, emergency and defensive operation, and technology in different learning environments. Environments included classroom, computer lessons, closed track and the open road. The course was not specifically designed to improve the students' SIPDE process.

Purpose of the Study

The objective of this study was to determine what, if any, effect an emergency vehicle operations course had on a student's ability to analyze driving environments. If the course had a positive effect on a student's ability to SIPDE the driving environment, the course would reduce the participant's crash frequency rate. Specifically there was one major difference between the traditional classroom delivery method and the online delivery method. The traditional classroom delivery method involved in car hands on exercises with the instructor critiquing them in real time. The online delivery method involved the instructor critiquing the students after exercise were completed. Although this study pertained to the visual and perceptual skills, not the participants' ability to drive a vehicle. For this reason the two main research question and null hypotheses for this study are as follows.

Research questions for this study were as follows:

1. Does the vehicle operations course titled TRS 235 improve the visual and perceptual skills of a student who participated in the course?
2. Does the delivery method (traditional classroom vs online) affect the improvement of the visual and perceptual skills of a student who participated in the course?

Null hypotheses for this study were as follows:

1. TRS 235 does not affect the visual and perceptual skills of students who participated in the course.
2. The delivery method (traditional classroom vs online) did not affect the improvement of the visual and perceptual skills who participated in the course.

Potential Significance

The results of the pre and post-test (DPT) indicate the frequency rate at which the participant would be involved in a crash. As the DPT was based on the five visual and perceptual skills (search, identify, predict, decide, and execute), the test identified what each skill's potential for collision would be. By comparing the DPT scores of the pre- and post-test, this study showed what effect an Emergency Vehicle Operations course has on a student's visual and perceptual skills. After comparing the pre and post test results, it was determined that the participants improved significantly over the course of class. Results of this study also show that students who participated in the online delivery format performed significantly higher than the students who participated in the traditional classroom setting. Comparing the Pre-Test mean of 136.06 to the Post-Test mean of 142.14, this not only showed a significant difference, but showed that the mean crash frequency rate per million miles decreased from 14.36 to 4.16. The overall performance of the participants went from "Average Functional Skills" to "Above Average Functional Skills" (Weaver, 1996, p.8). The study provided data regarding the sequence of the students by gender, age and personality type. While this study does not discuss the physical performance of the participants, it suggest that online training was no less effective than traditional classroom training, regarding visual and perceptual skills.

Overview of Methods

This study utilized pre-existing data provided by the Traffic Safety Institute at Eastern Kentucky University. Traditional classroom and online students who participated in TRS 235: Emergency Vehicle Roadway Operations Safety Course completed the Driver Performance Test prior to and after completing the course. Both delivery methods of TRS 235 had the same objectives. TRS 235 objectives can be found in Appendix C. The researcher obtained records without identifying characteristics.

The study discovered that TRS 235 was not designed specifically around visual and perceptual skills, but to provide driver skill enhancement and reduce incidents. Because the Driver Performance Text (DPT) examines visual and perceptual skills in a quantitative way. Quantitative observation was utilized to examine the influence TRS 235 had upon participants. The five visual and perceptual skills utilized in the DPT and this study were: search, identify, predict, decide, and execute. A more detailed description of the methods utilized in this study can be found in Chapter 3.

Definition of Terms

Decide

The term *decide* refers to the driver's ability to make informed decisions based on what the driver predicted would happen. The *decide* step focuses on the minimization risk, in relation to the techniques a driver takes to adjust speed and lane position.

Driver Control Sequence

The driver control sequence is proper method a driver must follow to gain the most control over the vehicle. A driver has the most control over a vehicle when he/she follows the three step sequence of vision, motion and steering. The first component of the driver control sequence is vision. The driver should look to where he/she wants the vehicle to go. This principle also applies to moving or operating other forms of transportation. Second the driver should either apply the brake to slow or apply the acceleration to speed up. In the final step, a driver then may use the steering wheel to control where the vehicle travels.

Drive a Vehicle

The term *drive* in *drive a vehicle* refers to the person controlling the vehicle's maneuvers in a safe and controlled manner. This 'driver' typically has more knowledge and training then a person who can operate a vehicle, to make informed, precise maneuvers with a vehicle.

Driver Education

The term *driver education* describes an environment in which a novice participant receives training in the area of vehicle operation, vehicle and roadway regulations and basic knowledge of the operations of a motor vehicle.

Due Regard

Due Regard in relation to driving would insure that safe passage is insured. "Would be to compare the actions of a reasonably careful person, performing similar duties, under similar conditions, to the acts of the person in question" (Childs, 1986, p.25).

Enhancement Course

The term *enhancement course* describes an advanced driver skill course. *Enhancement courses* do not educate the student on operations of the vehicle but rather on the advanced techniques of safe, informed, precise control over the vehicle.

Participant and Student

The terms *participant* and *student* shall be used interchangeably. *Participant* and *Student* are not race, gender, personality or age specific. The terms participant and student refer to those individuals who were registered in the Emergency Vehicle Operations course.

Execute

The term *execute* refers the driver's ability to carry out the decision made based upon the information collected during the searching, identifying and predicting stages of the driving scenario.

Gross Negligence

Gross Negligence refers to the blatant reckless disregard of the consequences resulting from an act against another.

Hazard

The term *hazard* describes an action or event where interference or harm may be present prior to and/or against one's discretion by environmental circumstances.

Identify

The term *identify* refers to the driver's ability to recognize and interpret potential risks and hazards in the driving environment. Failure to *identify* potential risks or hazards could compromise the driver's margin of safety.

IPDE Process

The *IPDE Process* is how the mind interprets information. IPDE stands for identify, predict, decide and execute. This process pre-dates the SIPDE process, as researchers discovered a critical *search* step was missing.

Negligence

Negligence is when a driver fails to do what is required or simply careless. "Charges of negligence can be easily imposed in a motor vehicle accident because each driver has a duty to other motorists and pedestrians within a radius in which they could be injured" (Childs, 1986, p.26).

Operate a Vehicle

The term *operating* in the context of *operating a vehicle* refers to the person controlling the vehicle's maneuvers in a safe and controlled manner. This individual often only has limited control over the vehicle, allowing it to move forward, backward and make turns. The person only has the skills to operate the controls of the vehicle.

Oversteer

Oversteer describes how the vehicle reacts when the rear tires have lost traction with the road. *Oversteer* is most commonly referred to as drifting or fishtailing. This traction loss is typically caused by the driver taking turns too fast or accelerating too fast with a rear wheel vehicle; causing the vehicle to skid or spin out.

Pitch

Pitch describes the tilt of the vehicle to the front and back. As the driver accelerates, the vehicle's weight is shifted backward, causing the front end of the vehicle to *pitch* or lifts up, as the back of the vehicle *pitches* or dips downward. When a driver uses the brake the vehicle's front end will be forced downward as the weight shifts forward, causing the rear end of the vehicle to lift

Predict

The term *predict* refers to the driver's ability to estimate what will happen in the driving environment based on the searching and identifying stages.

Process

The term *process* describes the manner in which the brain gathers and analyzes information. An example of a *process* is SIPDE (Search, Identify, Predict, Decide and Execute). SIPDE is the process of what the brain goes though without even thinking about it.

React

React describes the action and method of action the driver makes when encountering a sudden or unpredicted event in an uncontrolled manner.

Regulation

Enforced by either federal, state, or local government. "Either a rule or a statue which prescribes the management, governance or operating parameters for a given group" (Glossary, 2016). If broken, publishable by fines, prison time, loss of license, or community service.

Respond

Respond describes the action and method of action the driver makes when encountering a sudden or unpredicted event in a controlled manner.

Risk

The term *risk* describes an action or event where interference or harm may be inflicted on one's self at one's own discretion.

Roll

Roll describes the tilt of the vehicle from side to side. *Roll* is most commonly felt when a driver turns the vehicle, the weight of the vehicle is pushed in the opposite directions, making the vehicle lean to one side.

SEE System

The *SEE system* is what the driver should refer to as he/she is driving. *SEE* stands for Search, Evaluate and Execute. The driver should constantly search or scan the driving environment, evaluate what is happening in the environment, and execute the best possible course of action. The *SEE system* was designed to condense what the driver had to refer to while driving. Prior versions of *SEE* included IPDE and SIPDE.

Search

The term *search* refers to the driver's ability to scan the driving environment with his/her eyes constantly. A lack of searching skills not only hinders the driver with false information, it puts others at risk. If the driver does not see other vehicles, motorcycles, pedestrians, the driver cannot maintain a safety margin.

SIPDE Process

The *SIPDE Process* describes how the mind interprets information. SIPDE is not how drivers assess the environment. The driver should not refer to the SIPDE Process while driving.

System

The term *system* describes the steps or sequence the driver reflects upon while performing an action. An example of a *system* is SEE (Search, Evaluate and Execute).

SEE is the drivers mental thought procedure.

True Emergency

According to Emergency Vehicle Operations, true emergency is a “situation in which there is a high probability of death or serious injury to an individual or significant property loss” (Lindsey and Patrick, 2007, p.47).

Understeer

Understeer describes how the vehicle reacts when the front tires have lost traction with the roadway. Understeer is most commonly referred to as the front tires hydroplaning. This traction loss is typically caused by the driver turning the wheel to quickly or pushing on the brakes to firm in a vehicle without Antilock Braking System (ABS); causing the vehicle to skid straight.

Vicarious Liability

“Vicarious liability is legal liability placed on one person for the acts committed by another person” (Lindsey and Patrick, 2007, p.47).

Willful and Wanton

Willful and wanton is the most serious form of negligence, with intentional unsafe acts against another person.

Yaw

Yaw describes the vehicle's horizontal turning around the vehicles vertical center of gravity axis. An example of *yaw* is when the vehicle's back tires skids out of the path of travel of the front tires, known as *Oversteer*.

Assumptions

This study strived to limit assumptions in an effort to eliminate inaccurate data. However, one assumption include that the data requested are correct and accurate. The second assumption was that the students actively participated in the course components.

Organization of the Study

The results of this study were presented in a clear and precise manner. The data that was analyzed and formatted include pre- and post-test SIPDE scores, pre- and post-test scores, Information regarding the participants' ages, genders, and personalities were also reported as part of this study. Due to the limited number of participants the records were not able to be analyzed by age, genders or personalities.

CHAPTER II

LITERATURE REVIEW

Existing literature related to this study is limited and dated. The foundation of this study was based upon studies related to the TRS 235 course material, *Emergency Vehicle Operations* text, improvement programs, naturalistic, Driver Performance Test, and wired that way. Although the literature may be dated, the effectiveness and foundation holds true today. Only the vehicle's physical characteristics and technology has changed. The way in which driver searches, identifies, identifies, predicts, and executes his or her decision has remained the same. Although traffic safety is ever changing, the foundation of safety remains the same. The key to traffic safety has been, is and will always be education.

Emergency Vehicle Operations Text

TRS 235 Emergency Vehicle Roadway Operations Safety course in both the on-campus and online format utilize the text: *Emergency Vehicle Operations* by Jeffrey Lindsey and Richard Patrick. The text describes and discusses the importance of training, skills, procedures, processes and systems. The courses, however, take it one step further than the text. The courses require participants to perform the skills and tasks to efficiently control a vehicle. Although the two courses have the same objectives, the on-campus course requires the student to participate in on range exercises. The online courses require the participants to perform the skills in a safe manner while being video recorded. The online participants then upload the videos to the instructors to show they have performed the exercises. The text is broken down into: leadership, the right people, regulations, procedures, emergency vehicle characteristics, operations, communications, maintenance, roadway operations, and special operations.

Leadership and Management

According to Abraham Maslow, a researcher of human needs, it was determined that individuals would only achieve success if basic needs were provided. Maslow's pyramid included: physiological needs, safety and security needs, belonging needs, esteem needs and self-actualization needs. Among this pyramid of needs one could articulate that some type of training could be required at each level. Training regards to driving an emergency vehicle in a safe and precise manner falls under the secondary level of the pyramid, safety and security needs.

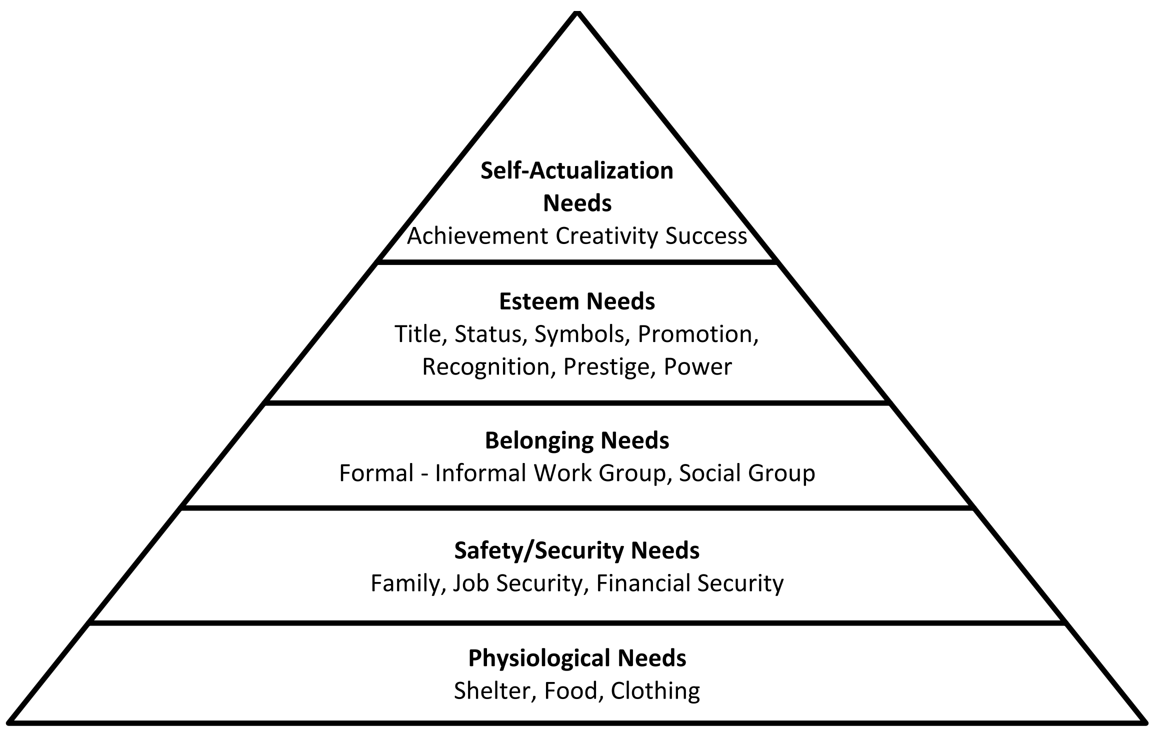


Figure 2.1: Maslow's Hierarchy of Basic Human Needs

Source: Lindsey, J., & Patrick, R. (2007). *Emergency Vehicle Operations* (1^{st} ed.). Upper Saddle River, New Jersey: Pearson Prentice Hall.

Among the safety / security needs for job security, the employee must have leadership or managers with experience to prioritize goals. Effective leadership must be able to outline, promote, enforce and evaluate driving goals. The primary driving goals of leadership include: (1) a quick and safe response time to the scene, (2) navigate the most direct route to the appropriate medical facility in accordance with state and local laws, (3) without unnecessary interruption, provide smooth and comfortable transportation, (4) under all circumstances, operate safely with due regard for the public, and (5) comply with policies, protocols, laws, rules, states, regulations and standards of care (Lindsey & Patrick, 2007, pp. 6-7). While these goals provide a safe driving environment, there is a lot of training, preparation and evaluation that must occur in order for the goals to be executed. To execute these goals the driver must have the proper education to be able to read and perform in accordance with state and local laws. The driver must have the training, coordination and the ability to operate and drive the vehicle. The driver must have the willpower and ability to be physically alert and conform to performance review evaluations.

Choosing the Right People

Reminiscent of the common expression of it's all about location, location, location, the Emergency Vehicle Operators' expression is "the three most important aspects in emergency driving are personnel, personnel and personnel" (Lindsey & Patrick, 2007, p. 12). This means that successful drivers start with driver selection or driver history, experience or proficiency and training. Like performance, training is the groundwork for safe practices. Department and leadership commitment to driver training and proficiency can have a profound effect on the success of the driver reducing crashes, collisions, injuries and fatalities (Lindsey & Patrick, 2007, pp. 10-11). "The type of the course, integration of classroom and applied practice, and instructor qualifications all contribute to the effectiveness of any training" (Lindsey & Patrick, 2007, p. 11). Trainings that have the most impact on the widest diversity of a group must present themselves in different ways. An example of this study in a different formation can be found in Appendix B, Concept Map. In attempting to provide a complete training program, considerations of such programs should include "human aspects, acquired abilities, vehicle characteristics and personnel records" (Lindsey & Patrick, 2007, p. 12).

The four categories of human factors that contribute to vehicle crashes include knowledge, skills, ability and attitude. (Lindsey & Patrick, 2007, p. 12). A lack of knowledge regarding vehicle dynamics, vehicle operations, traffic laws, and mental and physical limitations could result in serious injury or death. A critical qualification that departments should consider is the age of the operator. According to "a review of the *USFA Firefighter Fatalities in the United States* reports (FEMA, 2004) suggests that age (both young and older) appears to be a factor in both fire apparatus and ambulance crashes" (Lindsey & Patrick, 2007, p. 12). As Lindsey and Patrick state: "An emergency vehicle driver's knowledge is vital concerning the vehicle, its features, behavior, and operational characteristics" (2007, p. 15). Linsey and Patrick found that the majority who enter into an emergency career do so at a young age, with typically only a few years of driving experience. With this information, departments should impose age limitations on who may operate departmental vehicles.

As the text suggests, choosing the right people to operate company vehicle is essential. Departments should review and evaluate operators' training certificates, licenses, mental and physical qualifications on an annual basis. Among ambulance drivers who were involved in fatal accidents, forty-one percent had prior citations on their driving records (Zagaroli, 2003). Personnel who are permitted to operate company vehicles should be chosen after consideration of their qualifications, driving history, physical capability and mental fitness.

According to the course text, there are four types of attitudes that drivers want to avoid. The first, immaturity, indicates someone who is only concerned with their own safety. Second is the show-off. This person is only concerned with their own image. Third, the laid-back attitude, is reflected by someone who is not concerned with time, even if it takes hours or days. Lastly, the comic, is reflected by a person who sees humor in everything regardless of severity or dangerous situations. The comic attitude will not panic, but will mask themselves with humor. (Lindsey & Patrick, 2007, p. 14) While different, these attitudes all have one thing in common. They create dangerous driving situations, due to the lack of concentration on driving.

Part of concentrating on safe driving, includes the driver's mental and physical fitness. The driver's mental awareness may affect the response rates the driver has when responding to the driving environment. "Drivers' physical fitness may be affected by their health and the amount of rest they are getting" (Lindsey & Patrick, 2007, p.15). The four examples of physical and mental fitness are as follows:

- "Drivers who have the flu may not be alert and at their best,"
- "Shoulder injuries may affect drivers' ability to maneuver their vehicles,"
- "Over-the-counter medications may make drivers sleepy," and
- "Lack of sleep can make drivers' response time slower" (Lindsey & Patrick, 2007, p.15).

TRS 235 covers, these same mental and physical fitness examples. Additionally, TRS 235 stresses that the driver should perform physical stretches prior to driving. Stretching of the arms and shoulders are highly suggested prior to performing evasive maneuvers. Performing evasive maneuvers may cause extra stress on the arms and shoulders. As one does not know when they may need to perform an Evasive Maneuver, one should stretch prior to driving every time. One should stretch prior to performing the Cadence brake exercise. As with evasive maneuver, one does not know when they might need to perform a cadence brake, so one should stretch their legs prior to driving.

TRS 235 and the text, *Emergency Vehicle Operations* briefly discuss driver judgement. However, TRS 235 discusses and examines driver judgment more in detail without specifically labeling it as judgement. The text specifies two terms that are important when discussing driver judgement; excitability and maturity. “Excitability: Becoming overly excited or agitated in a critical situation. Maturity: The ability to keep emotions in check while driving” (Lindsey & Patrick, 2007, p.17). Both are important, however neither can be exercised without experience and proper training. TRS 235 goes where the text cannot. TRS 235 provides classroom, simulator, and range or hands on training. This training is what allows the driver to make informed responses rather than reacting to a situation in the driving environment.

The way in which a driver learns new skills or learns to modify their skills in relation to the way in which they drive is referred to as Traffic Psychology. Traffic Psychology, developed in 2004 at the University of Hawaii by Leon James, influences personal driving skills. These skills include:

- “Chivalry (being polite to strangers),”

- “Charity (caring for the feelings of other road users),”
- “Freedom (showing self-responsibility),”
- “Family values (being nice to your passengers),”
- “Citizenship and respect for law and order (obeying traffic ordinance),”
- “Spirituality (recognizing subtle connectedness among traffic users),”
- “Morality and rationality (respecting people’s rights in public places),”
- “Empathy and sympathy (showing solidarity with other traffic users),”
- “National unity and integration (identifying with positive symbols),:
- “Creative driving practice (multitasking, recreation, artistic expression)” (Lindsey & Patrick, p. 17).

These skills or characteristics are important to understand and demonstrate when operating any vehicle, especially an emergency vehicle. When the driver is operating an emergency vehicle he/she is representing their department, agency, and or community. Drivers are required to make split second decisions and execute those skills in situation often under extreme stress and scrutiny.

There are several factors that can affect the way in which a person behaves, particularly when performing fine motor control functions. Driver Readiness is influenced by fatigue, health, personal problems, age, habits, shift workers, employee behavior, and education (Lindsey & Patrick, 2007, pp. 18-22). As a large number of factors can play a critical role in driving, it is important for the driver to know their health, limitation, strengths and weaknesses. Medical checks can help to identify drivers who may possibly suffer from diagnosable illnesses, such as:

- “Loss of consciousness,”

- “Cardiovascular disease,”
- “Neurological/neurovascular disorder,”
- “Mental illness,”
- “Substance abuse/dependency,”
- “Insulin-dependent diabetes,”
- “Rheumatic, arthritic, orthopedic, muscular, neuromuscular, or vascular disease that interferes with the ability to control and operate a motor vehicle” (Lindsey & Patrick, 2007, pp. 17-18).

There are three primary goals that emergency vehicle drivers should strive to achieve. The first goal is that the driver is responsible for and completely dedicated to the safety of other passengers and the community they are serving. Second, is to expect the unexpected and be prepared, willing and capable to handle any situation. Situations may include: weather, mechanical malfunctions, pedestrians, other drivers and distractions. The third goal is to avoid legal consequences by extensive training and applied practice. “Consequently, legal outcome can socially and economically ruin emergency service members as well as discredit the organization and the profession” (Lindsey & Patrick, 2007, p. 25).

Rules, Regulations and the Law

Although not pertaining to a driver’s visual and perceptual skills, there are several laws a driver must abide by. It is important for the driver to understand that even when he/she is operating an emergency vehicle he/she is subject to all traffic regulations. There are certain exceptions that emergency vehicle drivers can operate in when driving an emergency vehicle in an emergency. The driver must exercise due regard for traffic safety. The driver must understand when he or she is operating an emergency vehicle in an exemption, the driver can still be found criminally or civilly liable if they are involved in a crash.

Executing due diligence in regards to traffic safety include, exceptions to traffic regulations include, proceeding through a red traffic signal after pausing, exceeding the posted speed limit within laws, traveling against traffic flow, under extreme emergencies, or parking on roadways obstructing traffic to prevent injury or death. These privileges are dependent upon state, county, and or local ordinance. It should also be pointed out that these exemptions are only legal when the vehicle is being driven in emergency mode. The driver should know and respect these privileges and know where they may travel before the exception is no longer in effect.

When the driver is operating an emergency vehicle, they are representing not only themselves, but they represent everyone connected with the department. If an accident were to occur, lawsuits often impact: “organization as a whole, emergency vehicle operator(s), officer of the vehicle, vehicle crew members, chief executive of the organization, and board of directors and commissioners” (Lindsey and Patrick, 2007, pp.45-46). Because of the liability and public reputation, it is important for vehicle operators to have proper training, know the laws and regulations, and participate in refresher courses.

In respect to understanding and following all laws and regulations, drivers should have a sound understanding of the following terms: “True Emergency, Due Regard, Negligence, Gross Negligence, Willful and Wanton, and Vicarious Liability” (Lindsey and Patrick, 2007, p.47). These legal terms may help a driver to understand the importance and severity of operating an emergency vehicle.

Policy Procedures and Guidelines

TRS 235 focuses on driver skill enhancement. The text: *Emergency Vehicle Operations* discusses departmental policies, procedures, and guidelines. TRS 235 reviews mirror setting to reduce blind zones and vehicle inspections to insure the vehicle is in proper working order. While these elements are not required by law, they are implemented in department policies and procedures to protect the department and driver. Daily vehicle inspections are used to insure that the vehicle is in proper working order to prevent malfunction resulting in property damage, injury, or death. These policies help to insure uniformity within a department.

A policy regarding mirror settings may include mandatory use of the *Blindzone Setting BGE Mirror Method*. According to *BGE Mirror Method* approximately 60% of an estimated 630,000 annual Lane Change/Merge (LCM) crashes, resulted from the driver not seeing the other vehicle. The BGE Mirror Method, setting allows the driver to angle the mirrors in way that reduces blind zones. This method should be used for vehicles with rearview mirrors and at least one mirror on each side of the vehicle. The following image displays the blind zones of a vehicle as viewed from above.

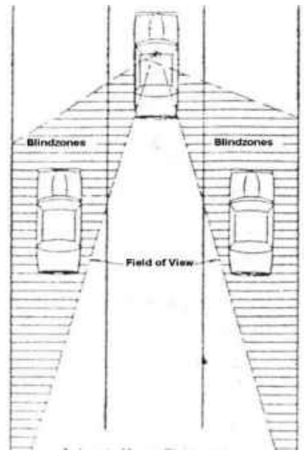


Figure 2.2: Vehicle with Blind Zone

Source: Platzer, G., & Kline, T.L. (2003). *BGE Mirror Method: A Simple Way to Reduce Blindzone Collisions and Side View Mirror Glare.* Eastern Kentucky University, Richmond, KY.

In viewing the image above, the shaded areas reflect the area the driver of the middle vehicle cannot view either in their peripheral vision or mirrors. After viewing this images one can clearly see that the there are two vehicles hidden from the driver in the blind zones. To setup the *BEG Mirror Method Setting* the driver should center their rear view mirror so they can see out the center of the back window. To set the left side view mirror the driver should lean to the left until their head touches the driver's side window, not leaning forward or backward. The driver should then position the left mirror so they can barely see the side of the vehicle in the mirror. To set the right side view mirror, the driver should lean to right until their head is in the center of the vehicle, not leaning forward or backwards. The driver should then position the mirror so they can barely see the side of the vehicle in the mirror. During the time the driver is setting the side view mirrors, the driver should not tilt the mirrors upward or downward. The vertical alignment of the mirrors should be made when the driver is sitting normally in the driver's seat. When the driver sits normal in the driver's seat, the driver should not be able to view the sides of his/her own vehicle in the mirrors. The following image depicts how the driver should position themselves to setup the BGE Mirror Method Setting.

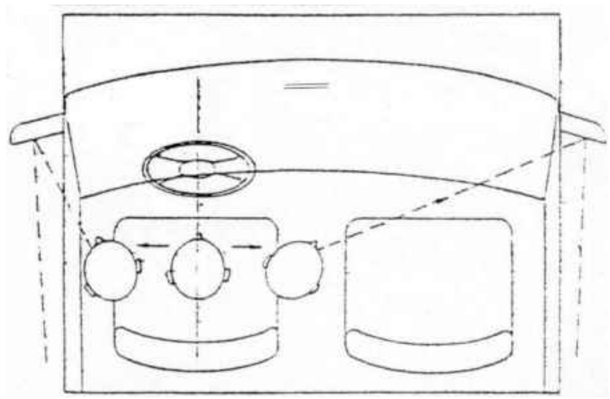


Figure 2.3: BGE Mirror Method Settings

Source: Platzer, G., & Kline, T.L. (2003). *BGE Mirror Method: A Simple Way to Reduce Blindzone Collisions and Side View Mirror Glare.* Eastern Kentucky University, Richmond, KY.

After setting the mirrors to the *BGE Mirror Method Setting* the driver does not completely eliminate the blind zones. However, this setting does minimize the blind zones to the point a vehicle cannot be hidden in a blind zone. Prior to the *BGE Mirror Method Setting,* there were two large blind zones. After setting the mirrors to the *BGE Mirror Method Setting* there are four small blind zones. The following image displays the resulting four small blind zones.

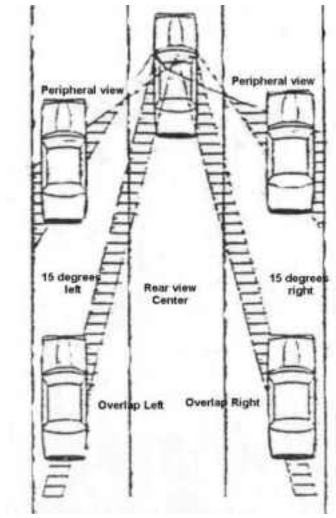


Figure 2.4: Vehicle Using BGE Mirror Method

Source: Platzer, G., & Kline, T.L. (2003). *BGE Mirror Method: A Simple Way to Reduce Blindzone Collisions and Side View Mirror Glare.* Eastern Kentucky University, Richmond, KY.

After viewing the above image of the BGE Mirror Method, one can see that the surrounding vehicles cannot fit fully in a blind zone. Part of each of the vehicles can be seen either prior to or after the blind zones. This method helps to improve the driver's visual techniques. It should be noted that when operating a vehicle using this method at slow speeds, the blind zones are large enough to conceal a pedestrian. When operating a vehicle without a rearview mirror, the side view mirrors should be angled back inward toward the vehicle displaying what is behind the vehicle. It should be noted that this will create blind zones similar to the Figure 2.2 with an additional blind zone directly behind the vehicle. If the vehicle has multiple side view mirrors, the driver should position the top mirror similar to Figure 2.4 and the bottom mirrors to the BGE Mirror Method Setting, minimizing the blind zone as much as possible.

Another example of a departmental policy regards non-departmental personnel as passengers. Some departments allow the transportation of passengers, while other departments prohibit transporting passengers. A driver of an emergency vehicle must be aware of departmental policies and follow them. If a departmental policy allows for the transportation of passengers, the passenger must follow all laws, regulations, policies and procedures pertaining to passengers. For their own safety and the safety of those around the vehicle non-departmental personnel should not drive or act as a spotters. Passengers should remain quiet or hold conversation to a minimum as not to distract from the driver's concentration. Much like the fellow crew members, passengers are the responsibility of the driver. Additionally, passengers may have to sign a waiver, depending upon departmental policy.

Emergency Vehicle Characteristics and Driving

TRS 235 utilizes the *Emergency Vehicle Operations* text which includes braking, stopping, backing up, changing lanes, turning, and passing, intersections, parking, and avoiding crashes as basic maneuvers. Among the requirements to enroll in the course is the possession of a valid driver's license and having the ability to perform vehicle operation such as: starting, stopping, drive, reverse, turning, parking, and communication. The basic maneuvers the course describes is the bare minimum operation of the vehicle which can also be performed in a personal vehicle. While starting an emergency vehicle compared to starting a personal vehicle is basic, the two tasks are widely different. For the purposes of this study, the skills covered in the course are designed to improve the participant's ability to drive an emergency vehicle. The tasks of driving a personal and an emergency vehicle differ, such as getting from Point A to Point B, the emergency and defensive skills are the same. The way in which a driver handles an oversteer or understeer situation in a personal vehicle is the same as it would be in an emergency vehicle. The course utilizes non-emergency vehicles, yet the skills are performed the same in both types of vehicles. The online course is designed with the same objectives.

A key aspect of space management or maintaining a safe driving environment is stopping distance. Stopping distance is made up of three components: "perception time, reaction time, and braking time (Lindsey & Patrick, 2007, p. 78). However, a more effective way of describing Total Stopping Distance is: "human-perception distance, human-reaction distance, and vehicle-braking distance" (Palmer, 2006, p. 254). The reason for this is the three parts (perception, reaction and braking) are measured not in time, but in distance (feet). The first component, perception, describes the amount of distance the vehicle has traveled while the driver recognizes there is a problem. The second, reaction, describes the distance the vehicle has traveled while the driver physically reacts to the problem, ie moving foot to brake. The last component, braking, describes the distance the vehicle travels from the time the brake is applied to the time the vehicle comes to a complete stop.

TABLE 2.1

STOPPING DISTANCE AT SPEED

Vehicle Speed (miles)	Perception Distance (feet)	Reaction Distance (feet)	Braking Distance (feet)	Total Stopping Distance (feet)
20 mph	15-22	15-22	17	47-59
30 mph	22-33	22-33	37.5	82-103.5
40 mph	29-44	29-44	68	126-156
50 mph	37-55	37-55	105	179-215
60 mph	44-66	44-66	150	238-282

Source: Palmer, J. (2006). *Responsible Driving.* Woodland Hills, CA: McGraw Hill/Glencoe, 255.

According to Palmer there are twelve factors that can influence braking capability. The twelve factors are composed of the following: braking systems, material of the brake pad, brake alignment, tire pressure, tire grip and tread, weight of the vehicle, suspension system, wind speed and direction, slope of the road, road smoothness, coefficient of friction, and how the brake is applied by the driver (Palmer, 2006, p. 255). As TRS 235 is driver training for larger vehicles, braking is a critical component. The driver must understand and be able to stop a vehicle safely in a short distance.

Basic habits include using both hands to operate the steering wheel. Few exceptions to using both hands include allowing one hand to operate the windshield wipers, directional signal, or other vehicle operational devices. Navigation instruction usage and radio usage should be left up to the passengers. All vehicle occupants should keep their arms, legs, and heads inside the vehicle at all times. Furthermore, operators should not engage in distracting conversation, eating, smoking or drinking while operating a vehicle. Hand position is critical when operating a vehicle. According to Lindsey and Patrick, the steering rule is to maintain the hand position of nine and three o'clock with an airbag or ten and two o'clock when the vehicle is not equipped with an airbag. The airbag deflation vents are located at ten, two and six. The operator's hands should not be located at the same locations as the airbag deflation vents in order to prevent burns if the airbag were to be deployed.

Easing off the acceleration, braking, and stopping are forms of deceleration. Each form of deceleration is commonly used. It is essential to know what each form is and when it should be used. To decelerate slowly the driver should slowly remove their foot from the acceleration pedal. This simple release of the acceleration pedal, combined with the vehicle momentum, will cause the vehicle to slow in speed, or decelerate. The driver should use the brake pedal to decelerate the vehicle quickly. Use of the brake pedal requires the driver to slow or stop a vehicle in a controlled manner.

TRS 235 covers controlled, threshold, trailing, jab, and cadence braking. Each braking technique is valuable in different scenarios and should be used correctly. Controlled braking is the most common braking technique. It requires the driver to input slow steady pressure to the brake pedal and should be used for everyday driving. Threshold braking is when the driver applies the maximum amount of pressure to the point just prior to the wheels locking up causing the vehicle to skid. Threshold braking should be used in emergency scenarios only. TRS 235 incorporates threshold braking in understeer and t-turn exercises. One of the most difficult types of understand is the trailing break. Trailing brake refers to when the driver applies a firm brake and slowly applies less and less brake pressure. TRS 235 incorporates the trailing brake in exercises such as: ACM, most turning, t-turn, and oversteer exercises. When a driver punches the brake pedal as hard and as fast as they can, it is referred to as a jab. A jab of the brake causes the weight of the vehicle to shift forward forcing the front of the vehicle to pitch forward. This method of braking is used to correct an understeer situation. A cadence brake is a receptive jabbing of the brake. Although not commonly used, this method is used in understeer situations. Anti-Lock Braking System (ABS) administers a cadence brake, only quicker. It would be hundreds of times faster than a driver could perform the technique. This technique can be used in a vehicle that is not equipped with ABS, thus creating the benefit of ABS.

TRS 235 impresses the point that there are two types of automotive brakes and each must be used correctly to function properly. The first type of brake is the drum brake. The drum brake has been utilized on both the front and rear wheels. However, the second type of brake is known as the disk brake. Disk brakes quickly replaced drum brakes on the front wheels of cars in the late 1950's and 1960's (Frank, 2003). The disk brake was a more reliable and method of bring a vehicle to a stop. The disk brake works when the driver steps on the brake pedal the calipers squeeze the disk pads to the disc/rotors, applying pressure and slowing the vehicle. The drum brake works when the driver steps on the brake pedal to increase pressure in the wheel cylinder, pressing the brake shoes outward. The vehicle begins to slow when the brake shoes are forced against the brake drum. The following images depicts the disk brake and the drum brake.

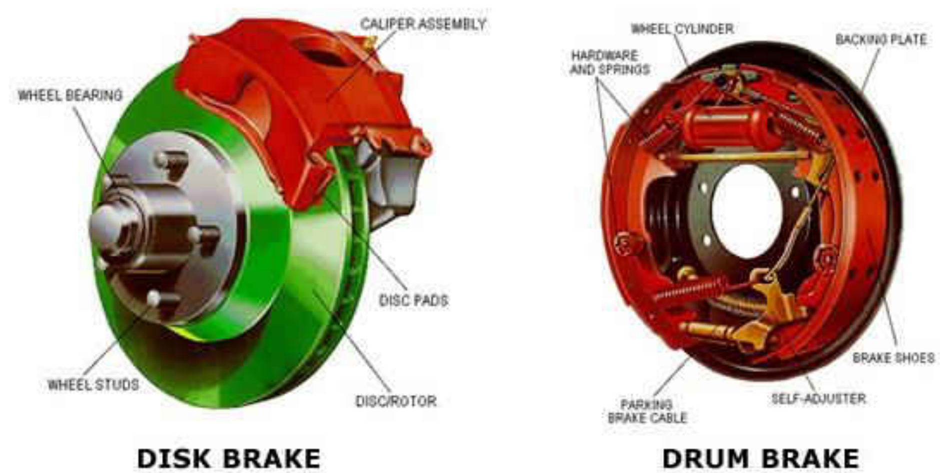


Figure 2.5: Disk Brake vs. Drum Brake

Source: Disk vs. Drum Brakes. Retrieved March 19, 2016, from http://www.ridetillidie .com/ckfinder/userfiles/images/disk-vs-drum-brake.jpg

When stopping a vehicle with disk brakes, the driver should apply increasing pressure to the brake pedal. If the vehicle begins to understeer, the driver should jab the brake. At no time should a driver pump the brake in a vehicle equipped with disk brakes in the front of the vehicle. Pumping a disk brake would cause the vehicle to enter or continue an understeer skid.

Emergency Vehicle Operations outlines seven primary guidelines for the driver to follow when backing a vehicle. As the text pertains to emergency vehicle, this includes larger vehicles such as fire apparatuses and ambulances. The guidelines for these vehicles include parking, audible notice, use of a spotter, hand and audible signals, use of mirrors, vehicle dimensions and limitation, and speed control. When the unit arrives at a location, the driver should position the vehicle in a manner that allows for quick departures. This involves backing into parking locations and having multiple ways to depart.

When backing a vehicle, the driver should engage audible reverse signals, typically a beeping sound. When backing, the driver should make use of their fellow responders as spotters. These spotters should position themselves in a manner they can clearly view the back of the vehicle and what is hidden from the driver's point of view. The spotter should also position themselves in a manner where they can be clearly seen by the driver. This position would allow the driver and the spotter to communicate with hand signals to navigate the vehicle safely. This spotter also prevents others from entering the vehicle's path of travel. All personnel involved in backing a vehicle should understand and utilize the same hand signals so as not to confuse the driver or create a dangerous driving environment. The driver should utilize the vehicle's mirrors when backing a vehicle. "The driver should not attempt to lean out to the mirror or turn around trying to see" (Lindsey and Patrick, 2007, p.80). The driver and all passengers should keep their heads and all appendages within the vehicle at all times when the vehicle is in motion.

When backing a vehicle, the driver may be focused on what is happening around the backend of the vehicle. It is important for the driver to also be conscious about what is happening around the front of the vehicle. “Either the right or left front may swing around and hit a fixed object that did not initially appear to be a potential problem” (Lindsey and Patrick, 2007, p.80). The front of the vehicle may swing out further in larger vehicles, because the front wheels are often located behind the driver’s seat. Finally, the driver must maintain low steady speeds to insure the smoothness and control of the vehicle. Both delivery methods of TRS 235 suggest that the vehicle should not be operated when backing faster than the spotter’s walking speed. If the driver operates the vehicle faster than walking speed, it will cause the spotter to rush. It is important whenever operating a vehicle, especially when backing, for everyone to remain calm and steady. If a spotter rushes, they are more likely to lose concentration and trip. If, at any point, the driver loses eye contact with the spotter(s), the driver should stop the vehicle. TRS 235 suggests that when practicing operating a vehicle, it should be done in a large open area free of distractions and closed to through traffic.

While Lindsey and Patrick outline the basic components of changing lanes, they do not tell the driver what steps they should take to accomplish lane changes, and under what circumstances. “Lane changing on multilane roads can usually be accomplished with little difficulty provided some basic rules are followed” (Lindsey and Patrick, 2007, p. 81). These rules include planning, signaling, space management, and smooth maneuvers. (Lindsey and Patrick, 2007, p. 81) These rules are followed in TRS 235, with some additions. For normal operations, the driver should maintain speed or adjust to the speed of the driver in lane the driver is entering. However, when performing an emergency lane change, the process is drastically different. An emergency lane change is called an emergency steering maneuver. Like the name suggests, emergency steering maneuvers should only be performed during an emergency. This maneuver is described in the Kentucky Drivers Manual as:

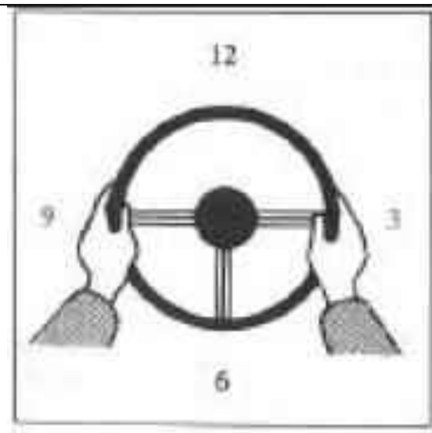
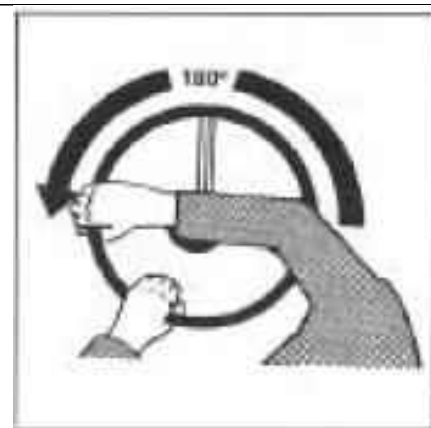
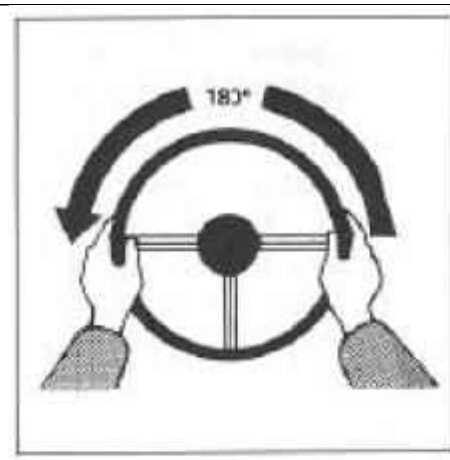
<table>
<tr>
<td>
</td>
<td>
</td>
</tr>
<tr>
<td>Best hand position for Driving.</td>
<td>Turn the steering wheel to the left as far as necessary to avoid the obstacle.</td>
</tr>
<tr>
<td>
</td>
<td></td>
</tr>
<tr>
<td>As you clear the obstacle, turn steering wheel right as far as necessary to get back into your lane.</td>
<td>As you return to your lane, turn the steering wheel left to straighten the vehicle.</td>
</tr>
</table>

Figure 2.6: Evasive Steering as Defined by KY Driver Manual

Source: United States of America, Kentucky State Police. (2012). *Kentucky Driver Manual* (p.31).

TRS 235 takes this same principal and defines it a step further. For driving speeds under 35 miles per hour (mph), first, the driver should adjust their vision to the open area they want to take the vehicle. Second, the driver must remove his or her feet from the break, clutch or acceleration pedals. Finally, the driver must perform the evasive maneuver. After the evasive maneuver, the driver may continue driving or come to a stop if necessary.

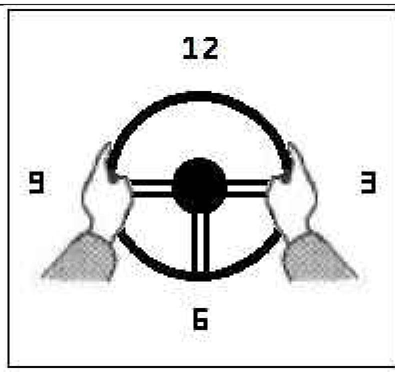
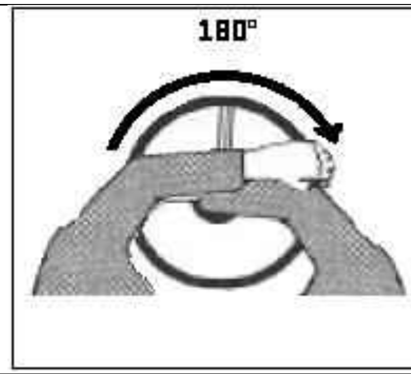
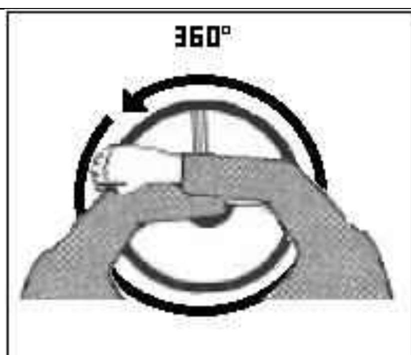
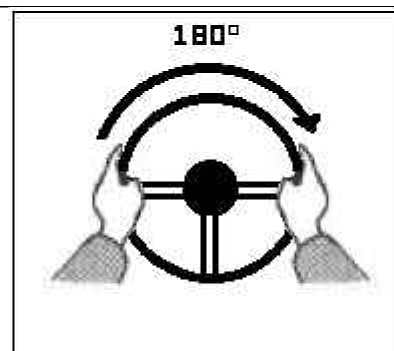
<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Locking their thumbs on the wheel's support beams at the 9 and 3 position. Un-like what is described in the Drivers Manual, the driver's thumbs should remain on the inside of the steering wheel throughout the maneuver.</td><td>While keeping both hands locked on the wheel, the driver must turn the wheel 180º (until the driver's arms bump), in the direction they want to maneuver the vehicle. This brings the front end of the vehicle to the desired Path of Travel (POT).</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Once the vehicle has traveled the desire distance to the side or into the other lane, the driver must turn the wheel 360º (until the driver's arms</td><td>The driver must straighten the wheel (returning to the original steering direction), to continue in a straight line. Only after the wheel has</td></tr>
</table>

Figure 2.7: Evasive Maneuver as Defined by TRS 235

bump), in the opposite direction of the first turn. This brings the rear end of the vehicle to the desired POT.	returned to the original steering direction, may the driver use the acceleration or the brake pedals.

Figure 2.7 (continued).

If the driver is applying pressure to either the brake or the gas pedal, the vehicle could result in an understeer or oversteer making the situation worse. If the evasive maneuver is conducted at speeds above 35 mph, the driver should only give half the steering inputs as when conducting the maneuver below 35 mph. It is important to remember that an emergency maneuver is for changing lanes in on emergency, not for changing lanes in normal operating procedures.

The two main principals that must be followed when turning a vehicle are (1) “always signal before turning,” and (2) “whenever possible, turn from one proper lane into another proper lane” (Lindsey and Patrick, 2007, p. 81). While these principles carry through to the TRS 235 course, the driver must also abide by the Driver Control Sequence. The driver should adjust their vision to the target area they want the vehicle to go toward, the break to slow the vehicle prior to the turn, and accelerate at the transition peg. This should be done using as little steering possible as to maintain the maximum control of the vehicle. Under normal turning procedures, the driver should use the push and pull steering technique. During emergency turning (Such as demonstrated in the TRS 235, T-Turn Exercise.), the driver should use the same vision technique. The driver should use a control-trailing-control break bringing the vehicle to a stop after a 90 degree turn. During this exercise the driver may use a hand-over-hand steering technique.

Although TRS 235 does not cover passing other vehicles, it does point out two important aspects in *Emergency Vehicle Operations*. There are two types of passing,

passing on two-lane roadways and passing stopped traffic. The first aspect is the procedure a driver should follow to conduct a safe and effective pass. The text outlines passing in seven steps. Steps for passing other vehicles should include:

- “Check traffic both ahead and behind,”
- “Check sides and double-check blind spots,”
- “Signal before initiating the pass,”
- “Accelerate while changing lanes,”
- “Signal before returning to the driving lane,”
- “Check mirror before returning to the driving lane,” and
- “Cancel directional signal and resume cruising speed” (Lindsey & Patrick, 2007, p.82).

The second aspect is the passing distance and the visibility distance required to pass a moving vehicle. When passing on a two-lane road, the approaching traffic is traveling at a combined speed of both approaching vehicles. If the first vehicle is traveling at 50 mph and the approaching vehicle is traveling at 50 mph, then the total speed of the two vehicle would be 100 mph. When passing stopped traffic, the driver should note that the stopped vehicle may begin to move forward or turn into the passing vehicles’ path of travel at any time. This creates a dangerous driving environment as it may leave the passing vehicle with no escape route. The following table depicts three things. The first column shows the starting speed of the passing vehicle. The second and third column shows the required distance required for the vehicle to successfully pass the vehicle and the required distance the driver must be able to see into their path of travel.

TABLE 2.2

PASSING DISTANCES AND VISIBILITY AT SPEED

Starting Speed	Passing Distance	Visibility Distance
30 mph	450 feet	900 feet
35 mph	525 feet	1,050 feet
45 mph	675 feet	1,350 feet
55 mph	825 feet	1,650 feet
60 mph	900 feet	1,800 feet

Source: Lindsey, J., & Patrick, R. (2007). *Emergency Vehicle Operations* (1st ed.). Upper Saddle River, New Jersey: Pearson Prentice Hall.

While negotiating intersections during an emergency, the driver should constantly visually scan the driving environment looking for potential hazards. The driver should remain in their lane if possible and change the light and or siren pattern. Regardless of the driving situation being an emergency or normal driving environment, the driver should slow and cover the brake with his or her foot. “Any controlled intersection requires a complete stop by the emergency vehicle driver” (Lindsey and Patrick, 2007, p.83). TRS 235 defines a controlled intersection as any roadway meeting another with a traffic control device, stop sign, traffic light or yield sign.

There are four things a driver can do to avoid a crash, according to *Emergency Vehicle Operations*. According to the text the driver needs to identify escape routes, brake smoothly and firmly, accelerate smoothly and rapidly, and steer to avoid a head-on impact. (Lindsey and Patrick, 2007, p.83) TRS 235 focuses on the same four aspects as the text and requires the participants to examine each more carefully. TRS 235 and the text strive to point out that a driver should not pump the brakes. Pumping the brakes will only lockup the brake causing the vehicle to enter an understeer situation.

Operations

In addition to obeying the standard civilian laws and regulation, an emergency vehicle operator must abide by additional emergency vehicle operators regulations. "Whenever emergency vehicle drivers operate emergency vehicles, they must adhere to the principles of defensive driving" (Lindsey & Patrick, 2007, p. 100). The defensive driving principles include: "predict the unpredictable, expect the unexpected, and handle any unexpected problems" (Lindsey & Patrick, 2007, p. 100). This theory is excellent, however it creates issues. How does one determine the unpredictable or the predictable? How does the driver determine the expected or unexpected? How can one handle unexpected problems?

The text suggests one of the methods for accomplishing the defensive driving principles is to utilize SIPDE. SIPDE is the process the mind uses to collect, process, determine what will happen in the driving environment and execute what he/she should to respond. SIPDE stands for search, identify, predict, decide and execute. First the driver needs to continuously search the driving environment, gathering information. The driver uses the information to identify what is happening in the environment and identify possible problems. These are problems that can be categorized as one or more of the factors that lead to crashes. Once the driver is able to identify possible problems, he/she can predict what will happen. With this prediction the driver will decide what the best course of action is. Finally, the driver will execute the decision in order to avoid a collision.

There are three categories of factors that lead to crashes. These crash factors are: human, environmental, and vehicular. According to a study contracted by the Department of Transportation in 1979, the Tri-Level Study of the Causes of Traffic Accidents Executive Summary; 93% of crashes could be contributed to human factors, 34% to environmental factors and 13% to vehicle factors (Treat, p. vii). While the study concluded that the majority of crashes could be contributed to an interaction of factors. While the Examination of Crash Contributing Factors Using National Crash Databases reports the definite cause of crashes to be 70.7% human, 12.4% environmental, 4.5% vehicle, and 2% drivers not responsible (National, p.89.).

The Kentucky Graduated Licensing Program is responsible for providing novice Kentucky drivers with the basic information to gather further information to prepare themselves for driving vehicles in accordance to Kentucky Revised Statutes. Avoiding crashes due to human factors includes searching for hazards, paying attention to the task at hand, restricting distractions, making speed and lane position adjustments, and communicating intentions. Crashes contributed to environmental factors can be controlled by the driver considering or predicting the roadway conditions and visibility issues that may arise. Vehicular factors can be controlled by properly understanding the vehicle's functions, capabilities, limitations, and actively maintaining the vehicle. (KY GLP, Session 2, Slide 9, 2014)

While SIPDE process describes the steps the drivers mind goes through, the SEE system is what the driver must abide by. Although SIPDE is detailed and accurate, it is difficult for the driver to remember and execute the process. SEE, is simple and quick. A driver can use the system of Search, Evaluate, and Execute; quickly allowing him/her to concentrate on driving the vehicle. Both SIPDE and SEE are incorporated directly into the Emergency Vehicle Operations course.

While the text revers to SIPDE, it does not discuss SEE. Instead to allow the driver to drive defensively, the text uses five visual habits. First, when steering, the driver must aim high with their eyes. When a driver is behind the wheel of a smaller vehicle, his or her vision should be aimed far from the vehicle, rather than close to the hood. In a larger vehicle such as a fire apparatus, the driver's vision should be aimed high or away from the apparatus. However, most novice driver's vision is aimed down or as close to the front of the vehicle as possible. As driving or operating a vehicle is not natural and must be learned, novice drivers try to operate the vehicle in present time and space. The driver must drive the vehicle in the future. This is due to the vehicle's blind zone. Second, the driver must gather the big picture, and evaluate what is going on in the driving environment. The driver accomplishes this with the next step, continuous scanning of the environment. Forth the driver insures other drivers see and recognize the emergency vehicle. This can be accomplished by using lights and sirens or by keeping the vehicle moving in the lane, and not remaining stagnant. Lastly, the driver must be able to identify and maintain escape routes in case their path of travel becomes blocked. (Lindsey and Patrick, 2007, p. 101.). As SIPDE more efficiently describes what the drivers mind goes through and SEE is more efficient for the driver to remember, they are covered in the course.

Communications

Communication is key to getting from place to place. The driver is responsible for communicating with other drivers and passengers. Passengers should be responsible for providing navigation directions to the desired destination. The driver should not be responsible for communication via radio or cell phone while operating a vehicle, as it is a distraction and prohibited by most departments and state laws. Everyone within a department should know and communicate with the same hand signals. Hand signals between the driver and spotters provide the driver with precise direction on how to operate the vehicle in tight areas. Spotters are observers outside the vehicle who direct traffic around the vehicle and provide the driver with information regarding the proximity of the vehicle in relation with objects, other vehicles, and parking information.

Maintenance

Vehicles are made up of thousands of parts. Each part is designed to withstand a certain amount of force or stress. Under extreme or excessive use, malfunctions will occur with parts and systems such as tires, brakes, anti-lock brake system, speed sensors, calipers, hydraulics, etc. While the drum brakes once had the braking market cornered, the more reliable disc brake quickly flourished. "These two types are often used together, with the disc brakes installed on the front wheels, where most of the braking effort occurs, and the drum brakes on the rear" (Lindsey & Patrick, 2007, p. 150).

The text discusses braking malfunctions and traction. "The traction grades from highest to lowest – AA, A, B, and C – represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete" (Lindsey & Patrick, 2007, p. 155). The text discusses possible tire issues such as tread wear, tire pressure, loading capacity, temperature, balance and alignment. TRS 235 briefly discusses possible issues and dives more into how to handle the vehicle when an issue with the tires occurs or technology malfunctions.

TRS 235 stresses proper tire inflation. A tire with proper inflation will perform to the maximum ability. Under inflated tires will roll under and make contact between the sidewall of the tire or the wheel rim and the roadway causing improper adhesion between the tire and the rim which could result in the tire rolling off the rim. Another result of under inflation is that the tire has more of a foot print than a properly inflated tire. This foot print is commonly referred to as tire patch. A tire that is over inflated has the same result of making improper contact between the tire and the rim. However, unlike under inflation, over inflation could result in the tire bursting. Another result of over inflation is that the tire has a smaller foot patch than a properly inflated tire. Below are images of tires with different inflation levels.

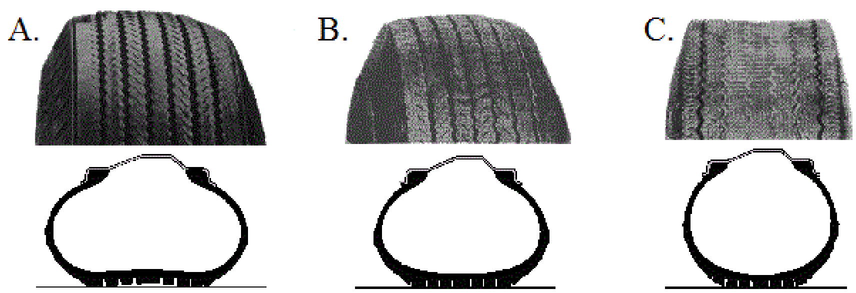


Figure 2.8: Tire Inflation

Sources: Ladies, Start Your Engines!: tire Pressure, Is It Really That Important? (2012, July 25). Available On-Line: http://ladiestartyourengines.blogspot.com

Figure 2.8.A is a representation of a under inflated tire. As depicted, one can see that the tire is wider, causing the tire to bow upward in the center of the foot of the tire. This results in more wear of the tire along the sides and sidewall of the tire. Figure 2.8.B is a representation of a properly inflated tire. Proper inflation causes the less stress on the tire allowing even wear across the foot of the tire. Figure 2.8.C is a representation of an over inflated tire. Over inflation of the tire causes more wear of the tire along the center of the foot of the tire. Under or over inflation of a tire can result in less traction between the tire and roadway where the tire tread is worn down. This lack of traction could result in an

understeer or oversteer situation. Proper inflation of the tires can help prevent loss of traction and improvement of a drivers handling of a vehicle. Tire tread and tire inflation are discussed in several TRS 235 course exercises.

The vehicle has the most uniformed tire patches during static traction or while the vehicle is at rest (Understeer, Slide 3). Depending upon the type and size of a vehicle, the tire patch dimensions will range. The front or rear end of the vehicle that has the larger tire patch will be where the majority of the weight is located. Vehicles with equal weight distribution will have four equal sized tire patches unless the rear tires are a different size then the front tires. The following Figure shows tire patches of a vehicle at rest. One should note that the front tire patches are slightly longer then the rear. This difference in tire patch size is due to the majority of the weight being toward the front of the vehicle.

Figure 2.9: Vehicle at Rest Tire Patches

Sources: Bondurant, B. (2003). *Bob Bondurant on high-performance driving*. St. Paul, MN: MBI Pub.

Once the vehicle is put into rolling traction or sliding traction, the tire patch dimensions change. When a vehicle is under acceleration the front tire patches become smaller as rear tire patches become larger. This is due to the pitch of the vehicle, or as the front end of the vehicle goes up the rear end of the vehicle goes down. The following image is of tire patches of a vehicle at acceleration.

Figure 2.10: Vehicle at Acceleration Tire Patches

Sources: Bondurant, B. (2003). *Bob Bondurant on high-performance driving*. St. Paul, MN: MBI Pub.

Having the opposite effect on a vehicle, deceleration will pitch the vehicle forward. A vehicle at deceleration will cause the tire patch dimension to be larger in the front of the vehicle than in the rear due to the weight of the vehicle shifting forward. The following image is of tire patches of a vehicle at deceleration.

Figure 2.11: Vehicle at Deceleration Tire Patches

Sources: Bondurant, B. (2003). *Bob Bondurant on high-performance driving*. St. Paul, MN: MBI Pub.

When a driver turns, a vehicle will experience pitch and roll. The vehicle will pitch forward and roll to outside of the turn. The turn pushes the weight of the vehicle toward the front and opposite of the direction of the curve. Thus if the driver turns the vehicle to the right, the vehicle's tire patches would show a larger patch on the front left of the vehicle. It should be noted that vehicles turning sharper or at different rates of speed may result in tire patches being different than what is described here.

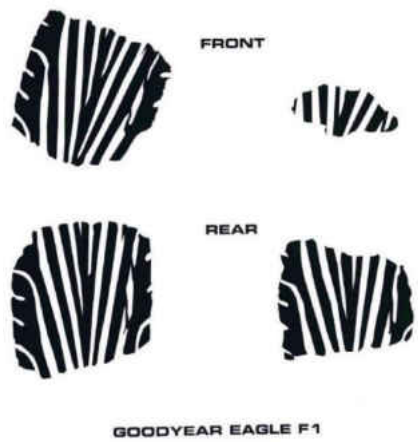


Figure 2.12: Vehicle at Turn Tire Patches

Sources: Bondurant, B. (2003). *Bob Bondurant on high-performance driving*. St. Paul, MN: MBI Pub.

Issues with tire tread wear, tire pressure or roadway conditions, can all result in either an understeer or an oversteer situation. Understanding of a vehicle weight distribution, vehicle tire patches, and tire tread will allow the driver to better handle the vehicle.

Roadway Operations

One can study, view, or ride along while conducting a driving skill, however with regards to physically driving a vehicle, there is no substitution for hands on training and practice. All individuals should be trained in the most basic operational skills through the most advanced handling techniques. Administrative staff need to experience this training to fully understand what the driver may go through. Dispatchers need an understanding of driver techniques to understand and direct responders in the safest way possible. This will allow everyone to have a full understanding of standard operating procedures (SOP) and standard operating guidelines (SOG). "Training should include policy and SOP/SOG review, hands-on practice with personal protective equipment, tabletop exercises and actual field drills" (Lindesy and Patrick, 2007, p. 179). Participants should be exposed to multiple learning styles and environments, as people learn differently.

Special Operations

TRS 235 identifies crash factors as being human, environmental, and mechanical. *Emergency Vehicle Operations* uses the International Fire Service Training Association (IFSTA), the Federal Emergency Management Agency (FEMA), and Vehicle Finance information Services (VFIS) factors. IFSTA categorizes crashes into "improper backing of the apparatus, reckless driving by the public, excessive speed by the fire apparatus driver, lack of driving skills and experience by the fire apparatus driver, and poor apparatus design or maintenance" (Lindsey and Patrick, 2007, p.222). IFSTA does not discuss weather or road conditions as a factor. However, weather could be a subcategorization could be contributed to the skill set of the driver. FEMA categorizes crash factors into "human factors, apparatus design factors, driving surface factors, emergency scene factors, and other factors" (Lindsey and Patrick, 2007, p.222). Although, VFIS has categorized crashes into several sub factors, the primary categories are "driver, vehicle, common rollover circumstances, physical dynamics of vehicle operations, and mechanics of vehicle operations" (Lindsey and Patrick, 2007, pp.222-

223). TRS 235 stresses the point that all exercises can be performed in personal vehicles and emergency vehicles alike.

TRS 235 Emergency Vehicle Operations Range Lessons

In accordance with "SEE," drivers should understand the difference between path of travel (POT) and line of sight (LOS). When most people get behind the wheel, they tend to watch things come toward the vehicle as perceived when watching television, looking only out the front windshield. However, to be able to drive a vehicle effectively, the driver should look where they want the vehicle to go at all times. An example of this is when drivers approach a turn. They typically only look over the hood of a vehicle, when they should be looking through the turn. To properly navigate a vehicle around a turn, the driver should look toward their target. This is illustrated in figure 2.13.

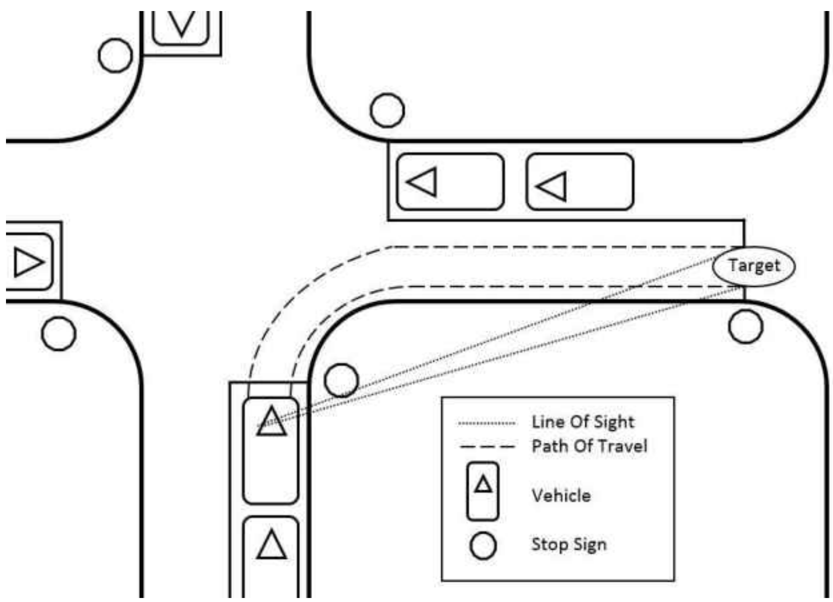


Figure 2.13: Path of Travel and Line of Sight

As seen in figure 2.13, the driver is looking toward the target area while the path of travel differs from the line of sight. The fine dotted line depicts the driver's LOS while the wider dotted line depicts the POT. Although the driver must constantly search the driving environment for potential issues, if the driver's vision is directly in front of the vehicle when turning, the vehicle will not follow the intended POT. Another example of where the driver's vision should be is when parking the vehicle. Some people have the tendency to look directly over the hood of their vehicle when parking. However, if they had the training covered in TRS 235, known as *BGE Blind Zone Elimination Method*, they would be able to park the vehicle with the front bumper zero to six inches away from the line in front of their vehicle. This is due to the driver having to drive the vehicle in the future not in the present. When operating a vehicle, the driver is unable to see the space where the vehicle is located.

The area around the vehicle the operator cannot see from the driver's seat is called the blind zone. While the blind zone is different for every model of vehicle, the rough dimension in relation to the vehicles are the same. Using the vehicle the driver is operating, from the driver's seat the driver cannot see approximately one vehicle length in front of the vehicle, one half vehicle width to the driver's side, approximately two vehicle widths to the passenger side and approximately three vehicle lengths behind the vehicle. The driver should position themselves correctly in the vehicle. Their head should be in approximately in the same position, thus giving every driver the same view. Due to federal automobile manufacture guidelines, every vehicle manufactured or sold new in the United States must meet the same dimension guidelines.

The three useful fields of vision are Focus, Central and Peripheral (Kline, 2003). Each field is critical when it comes to driving a motor vehicle. First is Focus Vision, otherwise known as Focal or Foveal Vision. Focus Vision allows humans to focus on individual letters, numbers and identify detail. Focus vision is independent of the other fields of vision. Widening outward from the focus vision, is Central Vision. Central Vision allows the for color and shape identification. Central Vision is dependent on where the Focal Vision is focused. The most outward vision is the Peripheral Vision. Peripheral Vision allows for color identification and motion detection. Peripheral Vision is dependent upon the focus of the Focal point of view and cannot identify objects. The Focus (A), Central (B), and Peripheral (C) is represented in the diagram below.

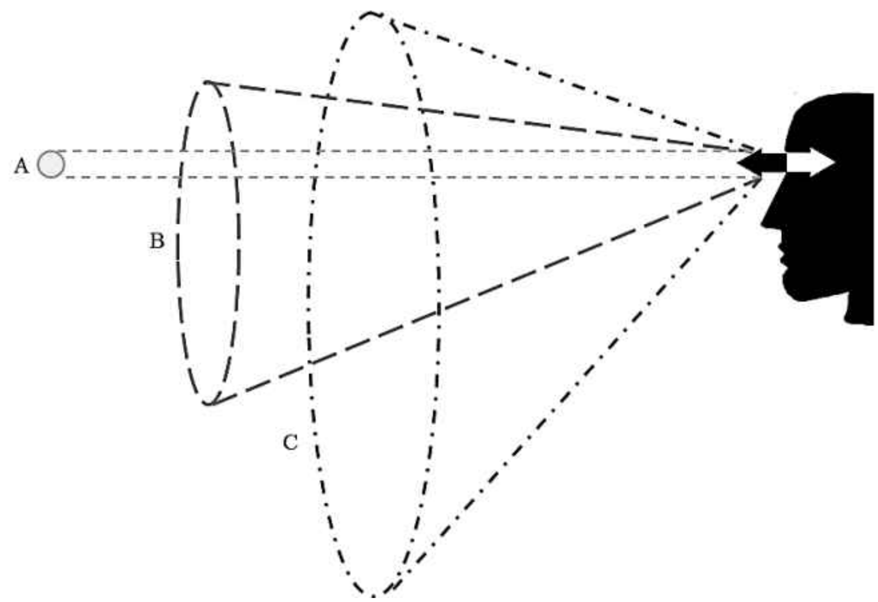


Figure 2.14: Visual Fields

Source: Kline, T. (2003). *Mental Perception*. Lecture presented at Eastern Kentucky University, Eastern Kentucky University, Richmond.

<u>Improvement Programs</u>

In 2010, Wei Zhang studied the effectiveness of driver improvement programs across the state of Iowa. The Zhang study was funded by the Department of Transportation (DOT), and included over twelve thousand participants located at seventeen driver improvement programs. Zhang was determined to see what, if any relationship existed between driver's ages and gender, and their conviction and collision rates. The Iowa

Motor Vehicle Division provided Zhang data without identifying characteristics. “Among the 6,700 (75%) drivers who completed the course satisfactorily, 73% of drivers had no actions and 93% were not involved in a crash during the probation period” (Zhang, 2010, p. viii). According to Zhang, the satisfactory group had lower conviction rates than those who fell under the unsatisfactory group. Zhang also found that “male drivers and young drivers (30 years of age or younger) incurred more convictions, while older drivers (40 years of age or older) had fewer crashes in both the satisfactory and unsatisfactory groups” (Zhang, 2010, p. viii).

The Florida Driving Knowledge Examination test in 1978 and 1979 were administered and evaluated by Barbara Wright of Florida State University. Wright while evaluating the tests, examined the participants’ general driving knowledge test and driving skills both independently and combined. Wright found a significant relationship between driving knowledge scores and student driving performance. However, Wright did not conclude any relationships between driving skills and knowledge items.

In 2013, Christopher Millard conducted a study examining the visual and perceptual skills of TRS 233: Emergency and Defensive Driving Techniques Course; offered at Eastern Kentucky University (EKU). TRS was designed to evaluate the effectiveness of the participant’s searching, identifying, predicting, deciding, and executing skills. As the TRS 233 course utilized the same Driver Performance Test, Millard found a significant difference in the student’s visual and perceptual skills.

Over the course of Millard’s study, he determined that the student’s DPT scores improved significantly. Millard was able to determine that one of the TRS 233 student’s visual and perceptual skills did not improve, predict. Millard contributed this to TRS 233 “not designed specifically to match the DPT” (Millard, 2013, p.16). TRS 233 was only offered in the traditional delivery format and was available as a free elective to EKU students.

Naturalistic

Although this study pertained to motorcycle riders, the same naturalistic eye tracking software is used in all areas of transportation. Terry Smith conducted his study on the effects of sight distance training on visual scanning techniques. Smith’s purpose in conducting this study was to determine if a rider’s visual behavior differentiates between the three categories of experienced riders, untrained-beginners, and trained-beginners included in the study. During the study each participant’s point of vision was recorded and evaluated to determined where the riders was looking by the use of specially designed helmet camera. The data collected from the videos was analyzed to determine how far the rider was looking into his/her path-of-travel (POT). The motorcycles used in the study were outfitted with a Global Positioning System (GPS) to record and determine the rider’s speed and stopping distance.

Smith was able to determine that sight to stopping distance ratio fell below “1.0 more often for beginner-untrained riders than for beginner-trained and experienced riders” (Smith, 2013, p. iv). Smith was also able to conclude that experienced riders moved faster in curves on the open road and beginner-trained riders moved faster in curves on the close course. The experienced riders and the trained-beginners showed a significantly shorter gaze than the beginner-untrained group with a confidence ellipse area of 95% (Smith, 2013).

The text discusses four basic driving systems: Smith, Perceptual, Cooper, and Mottola's Zone Control System. Each system is composed with different aspects to accomplish the same objective of keeping a safe distance between us as the driver and surrounding vehicles. Each system is composed of four components (searching, evaluating – assessing problems, evaluating – risk decision, executing - responding) and a following interval. It should be noted that no one system is superior to another. Each has its own benefits. The national Safety Council (NSC) recommends that the driver maintains a minimum of three seconds following distance and the addition of one second for each mitigating factor (Kline, 2014). Mitigating factors include, but are not limited to, weather, light, visibility, roadway conditions, and the driver being a novice.

The Smith System created by Harold Smith and focuses on the larger picture of driving. The Smith System includes the driver keeping their eyes moving, aiming high to gather information pertaining to the big picture. The evaluating component includes assessing potential problems with information pertaining to the larger picture and finding ways out of situations. The evaluating risk decision of Smith's System includes always leaving yourself an escape route. The executing or responding component is making sure that the other drivers see us and anticipate what we about to do. The Smith System recommends a minimum of 2-3 seconds of following space with one car length for every 10 miles per hour (Kline, 2014).

The widely accepted Perceptual System focuses on space cushions around the vehicle. The searching component requires the driver to constantly scan the driving environment, search the path of travel for risks or hazards, and maintain a space cushion around the vehicle. While the driver evaluates the environment assessing problems, the he / she is required to maintain a scanning pattern of 2 seconds, 4 seconds and 12 seconds ahead of the vehicle to identify possible problems (Kline, 2014). During the evaluating and reduced risk component, the driver will minimize possible issues, separate themselves from potential risks or hazards, and compromise or find alternate driving routes. The driver will communicate their intentions and make speed and lane position adjustments as part of the execution and responds component. The Perceptual System requires a 2 second minimum following distance and 3 seconds or more depending upon conditions. Conditions include, but are not limited to: speed, weather, roadway conditions, vehicle limitations, driver capabilities, or traffic.

The Cooper Color Code System was created by Jeff Cooper as a military risk analysis system and focuses on color coding the surrounding area with different levels of risk. The Cooper System was a situational awareness management system. The first component, searching, involves the driver looking for danger in the driving environment. During the evaluating stage, the driver assigns a color to the situation. Each color corresponds to a risk level. The four colors and their level of risk are white, yellow, orange, and red. White means that the driver is unaware risk and is relaxed. Yellow refers to the driver being aware of his or her surroundings and being relaxed. Orange refers to the driver being alert to his or her surrounding and what is happening in the driving environment. Red means that something in the driving environment has triggered the driver's mental alertness to respond to a threat. The Cooper System does not discuss following distance.

The Zone Control System was created by Frederik Mottola, the same person who created the Skid Monster. The Zone Control System was designed to focus on Line of Sight (LOS), Path of Travel (POT), and keeping space open or free of other traffic. The

Zone Control System requires the driver to search for restrictions in the LOS and POT. The evaluation component requires the driver to assess changes in the different zones around the vehicle. Mottola designates six zones around the vehicle to help the driver determine location of other vehicle. The six zones are front, rear, left front, left rear, right front, and right rear zone (Mottola, 2007, p. 24).

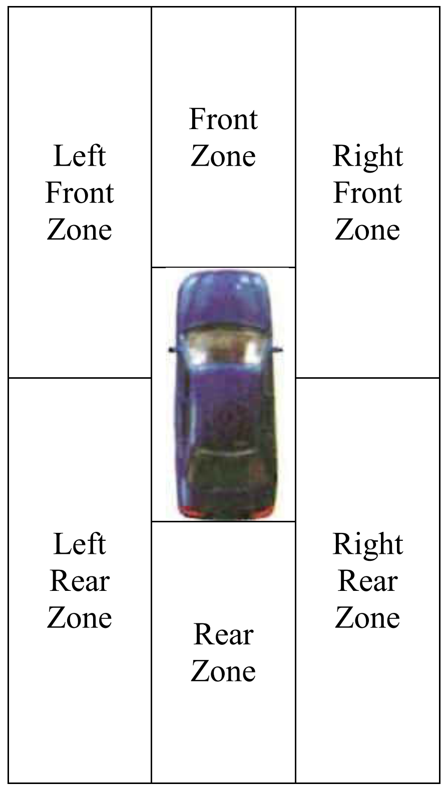


Figure 2.15: Mottola Zone Locations

Source: Mottola, F.R. (2007). *Partnership for expert driving, teacher, teen, parent* (7th ed.). Cheshire, CT, p. 24.

During the evaluating risk decision component, the driver should continually look for open space. The driver, during the executing or responding stage, should communicate his or her intentions and make proper speed and lane position adjustment. Mottola recommends a minimum of four seconds or more with following space depending upon driving conditions.

Driver Performance Test

The DeKalb County School System was charged with the evaluation of the Safe Performance Curriculum in DeKalb County Georgia, by the U.S. Department of Transportation (DOT) and the National Highway Traffic Safety Administration (NHTSA). The study was published on December 31st, 1980, per DOT-HS-805-886, *Impact Assessment of the Safe Performance Curriculum on On-Road Driving Test Performance.* Jack Weaver directed the DeKalb County Project. According to Weaver, the project's primary focus was to determine the effectiveness on groups of Control Students (CS, with a lack of formal driver education), Pre-Driver Licensing Training (PDL, a 30 hour course), and the Safe Performance Curriculum Training (SPC, an 80 hour course). Although the study was administered over a three year period, it included a total sample size of 459 students from year two of the study. During the second year of the study the population was broken down into 100 SPC, 117 PDL and 242 CS students (Ray & Brink, 1980, p.9). Overall, the total number of participants in the study over the three year period included "1543 in the SPC, 1505 in the PDL group, 519 in the CS group; for a total of 3567 students" (Ray & Brink, 1980, p. 9). The secondary objective was to determine if there was a relationship between participant gender, status, grade point average and the On-Road Performance Test.

Ray and Brink determined, at the conclusion of the study the students who participated in the Pre-Driver Licensing Training and Control Students groups fell short of the students who participated in the Safe Performance Curriculum. Ray and Brink determined that there was no relationship between the scores of the On-Road

Performance Test and the participants' grade point average, gender or socio-economic status.

The DeKalb Driver Education Project determined the guidelines of the study and indicated that further research was to be conducted. This project described the semi long-term results. The follow-up evaluation, issued in 1987, provided data of the three categories of participants (SPC, PDL, CS) and their records including convictions and collisions. The participants' driving records were provided by the State of Georgia. Records, from the date the participant completed the course through 1985, were requested, obtained, and analyzed.

During the six years following the project, the study concluded that the PDL students reduced their collisions approximately 6% and 5% in moving violations (Ray & Brink, 1987, p.6). "The Control Students showed 10% higher moving violation rates than the PDL group and 9% higher than the SPC group" (Ray & Brink, 1987, p.6). Additionally the follow-up study showed that there was a reduction in collisions and convictions for both genders in the PDL group. The SPC group displayed no significant reduction regarding collisions. Although only marginal the PDL group showed a reduction in collisions for the following four years after an initial reduction for the first two years.

The Driver Performance Analysis System (DPAS) is now owned and operated by the United Safety Council. DPAS was created by the late Jack Weaver, Ph.D. Weaver created the Driver Performance Test (DPT) in 1981 to determine the levels of an individual's perceptual driving skills. Although DPAS is available in several versions, the primary focus remains the same as intended by Weaver. The DPAS system analyzes the participant's visual and perceptual skills by allowing them to answer a single question per each of the forty short driving environment videos. DPAS or DPT can be used to predict the frequency rate at which a participant may be involved in a collision. DPAS cannot predict a collision itself.

Participants who take part in the DPAS or DPT are subject to video situations that improve their driving visual and perceptual skills. The Driver Performance Test or DPT is composed of forty short videos with a single multiple choice question pertaining to each video. Each questions has four possible answers ranging from the most correct to the least correct. The regression of answers is always the same with a most correct answer and a least correct answer. Test answers are assigned numerical values in order of correctness to from most correct being worth five points, three points, one point, and least correct worth zero points. By simply adding the numerical values, the test will compute the participant's likelihood of being involved in a collision based upon his/her deficiency. With the analysis of key questions, one can compute the area(s) (SIPDE) that will lead to the participant's collisions. Appendix A includes a copy of the DPT Driver Competency Scale.

The DeKalb County, Georgia study performed in 1979-1981 was the foundation for Jack Weaver's Driver Performance Test. The Driver Education Knowledge Evaluation administer and the follow-up evaluation of the Safe Performance Curriculum Project concluded that there were relationships between performance and driving knowledge. The studies also concluded that differences were found between participants trained behind the wheel and those who were trained in the classroom.

As a result of Weaver's study, he was able to categorize driver's visual and perceptual skills of Search (S), Identify (I), Predict (P), Decide (D), and Execute (E) into a forty question test. Each of the SIPDE categories has eight short driving environment videos with a single multiple choice question per video and four possible answers. Additionally, the videos and questions posed in the DPT are not constant in driving environments. As driving environments are ever changing, the visual and perceptual techniques, SIPDE, are critical concepts. The answers range from most correct to least correct with a numerical value assigned to each answer (most correct worth five points, next correct worth three points, next correct one point, and the least correct worth zero points.) The Driver Performance Test is worth a total of 200 points, forty from each of the SIPDE categories. Weaver was able to determine a student score, percentage score, a mean crash frequency range per million miles driven, and a significance explanation for each aspect of the DPT. If a student scores a 101 on the DPT the first time and a 160 the second time, according to Weaver, the student's mean crash frequency rate per million miles driven was reduced from 36.79 to 4.16. Thus, the driver is less likely to be involved in a crash.

TABLE 2.3

DRIVER PERFORMANCE TEST / DRIVER COMPETENCY SCALE / MOTOR VEHICLE DRIVERS

Key	**Test Points**	**Percentage**	**Mean Crash Frequency Rate Per Million Miles**	**Significance**
DPT				
	165-200	83-100	2.97	Excellent Functional Skills.
	139-164	70-82	4.16	Above Average Functional Skills.
	103-138	52-69	14.36	Average Functional Skills.
	84-102	42-51	36.79	Below Average Functional Skills.
	50-83	25-41	63.05	Poor Functional Skills.

Table 2.3 (continued)

Key	Test Points	Percentage	Mean Crash Frequency Rate Per Million Miles	Significance
Search				
	35-40	88-100	3.81	Excellent Search Skills.
	29-34	73-87	7.17	Above Average Search Skills.
	21-28	53-72	15.40	Average Search Skills.
	15-20	38-52	41.15	Below Average Search Skills.
	0-14	0-37	79.83	Poor Search Skills.
Identify				
	37-40	93-100	4.17	Excellent Identify Skills.
	33-36	83-92	6.23	Above Average Identify Skills.
	23-32	58-82	17.23	Average Identify Skills.
	18-22	45-57	29.93	Below Average Identify Skills.
	0-17	0-44	47.17	Poor Identify Skills.
Predict				
	33-40	83-100	5.23	Excellent Predict Skills.
	26-32	65-82	7.73	Above Average Predict Skills.
	16-25	40-64	15.37	Average Predict Skills.
	11-15	28-39	29.65	Below Average Predict Skills.
	0-10	0-27	33.27	Poor Predict Skills.
Decide				
	30-40	75-100	3.01	Excellent Decide Skills.
	25-29	63-74	4.71	Above Average Decide Skills.
	17-24	42-62	13.08	Average Decide Skills.
	12-16	30-41	39.19	Below Average Decide Skills.
	0-11	0-29	74.14	Poor Decide Skills.
Execute				
	31-40	78-100	1.16	Excellent Execute Skills.
	26-30	65-77	4.41	Above Average Execute Skills.
	19-25	48-64	14.77	Average Execute Skills.
	13-18	33-47	29.11	Below Average Execute Skills.
	0-12	0-32	37.17	Poor Execute Skills.

Source: Weaver, J. K. (1996). *Driver Performance Test II*. (p.8).

Personalities

According to *Wired That Way* there are four basic personality types. One can identify their personality by answering two simple questions. The two questions are: “Do you like things to move faster or slower? Would you like to work with people or on a task?" (Registration, 2015, p.2). While some people could fall under multiple personality types, Littauer claims that people have only one main personality. However, when stressed, tired, distracted or under the influence of drugs or alcohol, people can are often masked with a second personality type. The individual will return to the primary personality type once they have recovered. The four personality types are Popular Sanguine, Peaceful Phlegmatic, Powerful Choleric, and Perfect Melancholy.

According to Littauer, each personality has their own strengths and weaknesses. People who answer the two questions with responses of "slower" and "task" are classified with a perfect personality. The perfect personality strengths include: empathetic, succinct, analytical, organized, compassionate, and trustworthy (Littauer, 2006, p.8). The perfect weaknesses include: being hesitant, uptight, analytical, hypochondriac, emotionally vulnerable, self-righteous, critical, fearful, fragile, hermit, moody, aloof, and obsessive (Littauer, 2006, p.8). People who answer with "faster" and "task" are known as powerful. The powerful personality often shows strengths including: productive, visionary, multitask abilities, open-minded, organizes people and resources, and motivates others well, constructive, leader, purposeful, and focuses (Littauer, 2006, p.8). The powerful weaknesses include: overly assertive, angry, belligerent, usurps authority, untouchable, narrow-minded, knows it all, bossy offensive, controlling, and argumentative (Littauer, 2006, p.8). People who answered with "slower" and "people" are classified with the peaceful personality. The peaceful personality display strengths of being loyal, faithful, witty, dependable, steady, consistent, willing, patient, and calm (Littauer, 2006, p.8). Weaknesses of the peaceful personality include: being dull, indecisive, spineless, lazy, wish-washy, sarcastic, passive-aggressive, boring, no initiative, and obstinate (Littauer, 2006, p.8). Finally, people who answered “faster” and “people” are known as having a popular personality. The popular personality has strengths such as: energetic, warm, enthusiastic, approachable, and inviting, cheerleader, and self-confidence (Littauer, 2006, p.8). People with popular personalities often have weaknesses including: being loud, self-centered, shallow, overly dramatic, easily distracted, monopolizes conversation, impulsive, irresponsible, and undependable (Littauer, 2006, p.8).

While there are several types of personality quizzes, *Wired That Way Personality Profile* requires the participant to answer the two questions by choosing whether they like to work in groups or alone and whether they prefer to work fast or slow. These two questions are to be answered by the participant quickly and without in-depth thought. Any hesitation or delay in answering the questions could alter the participant’s personality profile. The question regarding “faster” or “slower” preference is not specifically related to driving or walking. The question regarding “task” or “individual” is not specifically related to work or free time. The questions should be answered from an overall perspective. This opens up the legitimacy of the Personality Profile. However, *Wired That Way* explains this as the participant only having one true personality. Any type of discrepancy in the way a participant answers a question is explained by the participant’s health, and wellbeing.

Online VS. Traditional Education

Barry Vroeginday study’s *Traditional VS. Online Education: A Comparative Analysis of Lerner Outcomes,* included 657 course records. Participants of Vroeginday’s study were 50.7% traditional students and 49.3% online students. Demographic data collected during the second phase of the study resulted in a response rate of 23.6% of the total population; 48.34% traditional participants, 51.6% online participants. (Vroeginday, 2005, p. 116) The studies three hypotheses were as follows:

- Hypothesis 1: "There is no significant difference in final exam scores among traditional and online learners" (Vroeginday, 2005, p. 46).
- Hypothesis 2: "There is no significant difference in overall course scores among traditional and online learners" (Vroeginday, 2005, p.46).
- Hypothesis 3: "The demographic variables (i.e., gender, marital status, age, number of children, age of the youngest child, employment status, income, and highest education level) examined for this study do not play a statistically significant role in determining which group of learners, traditional or online, is more likely to score higher on the final exam and in the course" (Vroeginday, 2005, p. 46).

The results of this study concluded online participants performed significantly higher than the traditional participants, thus refuting the first hypothesis. The study confirmed that there was no significant difference in overall scores among both traditional and online participants, thus accepting the second hypothesis. The study concluded the third hypothesis was accepted as significance was not established. There was no significant difference between age, gender, number of children, age of the youngest child, income, employment status, or highest education levels.

CHAPTER III

METHODOLOGY

The method of this study included the collection, analysis and reporting of preexisting data on student gender, personality, and DPT pre-test and post-test scores. The DPT was administered to the online and on campus students of TRS 235. Students were required as part of TRS 235 course work to complete the pre-test with the first two weeks of the course and post-test within the last two weeks of the course. The students also were required to submit their gender and answer the personality questionnaire.

TRS 235

Although TRS 235 was not designed to teach SIPDE specifically, every component of the course could be categorized under one of the visual and perceptual techniques of SIPDE. The Driver Performance Test II or DPT was designed to measure and evaluate a participant's visual and perceptual skills. The DPT was based upon the SIPDE (Search, Identify, Predict, Decide and Execute) concept.

TRS 235 requires participants to enter the course with the basic vehicle operational skills of starting and stopping, driving and reversing, turning, parking, and communication. TRS 235 is composed of the three primary categories emergency and defensive operations, learning environment, and technology. The emergency and defensive operations section includes the concepts of SEE, evasive actions, understeer, and oversteer. Learning environment is composed of classroom, computer lessons, closed track, and open road lessons. Technology includes elements such as occupant protection, crash avoidance, roadway design, and occupant comfort. The traditional on-campus class meets with the instructor during regularly scheduled class times to review course material and perform range lessons. The online class is able to operate at their own pace and schedule, allowing them to time to perform the range exercises and report back to the class. The online and traditional classroom courses are composed of the same curriculum and course objectives. Students are presented with the same lesson plans, assignments, and tests. Although this study was conducted over the period of four years. All online courses were facilitated by the same instructor, and all traditional courses were taught by the same instructor.

Variables and Measures

The DPT was composed of forty short video scenarios. Each video was followed by a single multiple choice question. Each question had four possible answers, ranging from the most correct to the least correct. Answers that are the most correct were valued at five points, then three points, then one point, and zero points for the least correct answer. Questions were designed to measure the student’s ability to use their searching skills, identify possible risks or hazards in the environment, make a prediction about what is going to happen, make the best decision or identify how best to execute the decision. Since the DPT was designed to strengthen the student’s ability to make the best decisions and not react to changes in the driving environment, the student was to respond by making the best decision based upon the environment and the possible answers provided. Additionally, the videos and questions posed on the DPT are not constant in driving environments. As driving environments are ever changing, the visual and perceptual techniques (SIPDE) are critical concepts. Results of the DPT were provided as separate SIPDE and total DPT scores. Students’ scores were then compared to Weavers’ Driver Performance Test / Driver Competency Scale / Motor Vehicle Drivers chart, table 3.1.

TABLE 2.3

DRIVER PERFORMANCE TEST / DRIVER COMPETENCY SCALE / MOTOR VEHICLE DRIVERS

Key	Test Points	Percentage	Mean Crash Frequency Rate Per Million Miles	Significance
DPT				
	165-200	83-100	2.97	Excellent Functional Skills.
	139-164	70-82	4.16	Above Average Functional Skills.
	103-138	52-69	14.36	Average Functional Skills.
	84-102	42-51	36.79	Below Average Functional Skills.
	50-83	25-41	63.05	Poor Functional Skills.
Search				
	35-40	88-100	3.81	Excellent Search Skills.
	29-34	73-87	7.17	Above Average Search Skills.
	21-28	53-72	15.40	Average Search Skills.
	15-20	38-52	41.15	Below Average Search Skills.
	0-14	0-37	79.83	Poor Search Skills.
Identify				
	37-40	93-100	4.17	Excellent Identify Skills.
	33-36	83-92	6.23	Above Average Identify Skills.
	23-32	58-82	17.23	Average Identify Skills.
	18-22	45-57	29.93	Below Average Identify Skills.
	0-17	0-44	47.17	Poor Identify Skills.
Predict				
	33-40	83-100	5.23	Excellent Predict Skills.
	26-32	65-82	7.73	Above Average Predict Skills.
	16-25	40-64	15.37	Average Predict Skills.
	11-15	28-39	29.65	Below Average Predict Skills.
	0-10	0-27	33.27	Poor Predict Skills.
Decide				
	30-40	75-100	3.01	Excellent Decide Skills.
	25-29	63-74	4.71	Above Average Decide Skills.
	17-24	42-62	13.08	Average Decide Skills.
	12-16	30-41	39.19	Below Average Decide Skills.
	0-11	0-29	74.14	Poor Decide Skills.
Execute				
	31-40	78-100	1.16	Excellent Execute Skills.
	26-30	65-77	4.41	Above Average Execute Skills.
	19-25	48-64	14.77	Average Execute Skills.
	13-18	33-47	29.11	Below Average Execute Skills.
	0-12	0-32	37.17	Poor Execute Skills.

Source: Weaver, J. K. (1996). *Driver Performance Test II*. (p.8).

Table 3.1 shows the range of scores the students could have scored in the column labeled test points. The maximum score a student could have scored in SIPDE categories is 40 points, with 200 under the total DPT. The percentage column shows the student's percentage score. The mean crash frequency rate per million miles driven column shows the frequency rate per million miles driven at which the student will likely be involved in a crash. The significance column shows how the student's scores relates to other drivers.

According to *Wired That Way,* there are four basic personality types. One can identify their personality by answering two simple questions. The two questions are: "Do you like things to move faster or slower? Would you like to work with people or on a task?" (Registration, 2015, p.2). While some people could fall under multiple personality types, Littauer claims that people have only one main personality. However, when stressed, tired, distracted or under the influence of drugs or alcohol, people can are often masked with a second personality type. The individual will return to the primary personality type once they have recovered. Participants who answered faster and people were identified as popular personality, faster and task identified as powerful, slower and people as peaceful, and slower and task as perfect. As discussed in chapter two, each personality has numerous strengths and weakness.

<u>Selection of Participants</u>

It is important to note that the selections of participants was not a sample but the population of participants in TRS 235 on campus and online during the timeframe the DPT was administered. While this study examined only EKU's TRS 235 course, there are other highly similar courses available across the country. Therefore, inferential statistics were calculated. Participants were collected from the TRS 235: Emergency

Vehicle Roadway Operational Safety Course at Eastern Kentucky University. As the TRS 235 course (both online and on campus) required participants to complete the DPT, all participants were included in the study. Participant records who are incomplete were requested. TRS 235 was offered online for one semester per year for four years at the time of this study, resulting in 38 complete records and one incomplete record. TRS 235 was offered in the classroom for one semester per year for four years at the time of this study, resulting in 42 complete records. Records that were incomplete, missing pre-test or post-test or an individual SIPDE score, were not incorporated in the final analysis of this study. A total of 80 complete records were obtained from the Traffic Safety Institute (TSI) at EKU.

Research Questions

The primary purpose of this study was to compare a student's ability to effectively use the SIPDE process when it comes to their driving ability at the beginning and end of the TRS 235 online and on-campus courses. The primary purpose of this study was to refute or provide evidence that an emergency vehicle operations course influences a participant's ability to use SIPDE in relationship to the visual and perceptual skills related to driving a motor vehicle. This study also examined the personality type of the participants to determine the personality makeup of the population.

Data Collection

Data were requested from the Traffic Safety Institute office (TSI) at Eastern Kentucky University (EKU). All TRS classes fall under TSI. The data that were requested included: gender, personality type, SIPDE pre-test and SIPDE post-test scores. If one of the data items requested was missing, the record was still requested as is. TSI was asked to assign a generic unique identification number to each record so that no personally identifying information was accessible to the researcher. If a student had participated in the course multiple times, only the most recent record was requested. However, there were no students who participated in the course multiple times.

Data Analyses

Each participant was masked with a generic unique indemnification number by TSI. Data records include generic unique id numbers, gender, personalities, pre-test scores and post-test scores. The data were obtained in an electronic Excel Database. Once obtained, the data were stored on a secure, locked, private laptop. Utilizing IBM's SPSS, a Two-Way Between-Groups ANOVA was performed for final analysis of the data.

Subjectivity and Bias

Personal bias was not a factor in this study. This study utilize the scores of the data masking the records with generic unique identification numbers. No personal data were released by TSI or viewed by the researcher. Only incomplete records that were incomplete (missing SIPDE test scores) were not included in the final analysis of the study. However, incomplete records were reported as incomplete records.

Limitations

Limitations of this study included being limited to preexisting data, course structure and content, and data provided by TSI. No new data were collected as the data are preexisting. The largest limitation was the limited number of participants. This was a limitation for two reasons. First, a small sample size resulted in low statistical power to find differences that may actually exist. Secondly, a small sample size resulted in a lack of ability to run tests comparing disaggregated data, such as by gender or personality type. TRS 235 has only been offered online and in a traditional classroom utilizing the DPT for four years at the time this study was conducted. The courses are limited to operating one time per year, online in the fall and on-campus in the spring semesters. Each class has a cap of 24 students per semester. Several years would be required to obtain a sample large enough to the required sample to analyze by personality and gender.

CHAPTER IV

RESULTS

As outlined in the previous chapters, there is little recent research pertaining to driver skill enhancement in traditional classroom and online learning environments. By utilizing EKU's TRS 235: Emergency Vehicle Roadway Operations Safety course, this study was able to measure the effectiveness it had on its participants. Both the traditional classroom and online formats were composed of lectures, range, and assignments, and had the same course objectives.

Although TRS 235 was not designed to teach SIPDE specifically, every component of the course could be categorized under one of the visual and perceptual techniques of SIPDE. The Driver Performance Test II or DPT was designed to measure and evaluate a participant's visual and perceptual skills. The DPT was based upon the SIPDE (Search, Identify, Predict, Decide and Execute) concept.

Research Findings

As this study pertained to the visual and perceptual techniques of students in TRS 235 online and traditional classroom formats, it was essential that the courses were the same and had the same objectives. As outlined in chapter one, there were two research questions pertaining to this study.

1. Does the vehicle operations courses titled TRS 235 improve the visual and perceptual skills of a student who participated in the course?
2. Does the delivery method (traditional classroom vs online) affect the improvement of the visual and perceptual skills of a student who participated in the course?

After performing a Two-Way Between-Groups ANOVA, the researcher was able to reject both of the null hypotheses. The results presented in Table 4.1 showed that there was a significant difference between the mean pre-test (136.06) and mean post-test (142.14) scores for all participants, (F=4.14, p=.014). These results lead to the rejection of the hypotheses stating: TRS 235 does not affect the visual and perceptual skills of students who participated in the course. When viewing Table 4.2, deciding and executing online scores significantly improved. Utilizing Weavers' Driver Performance Test / Driver Competency Scale / Motor Vehicle Drivers chart in Table 4.1, the researcher was able to determine the crash frequency rates per million miles driven for the participants.

TABLE 2.3

DRIVER PERFORMANCE TEST / DRIVER COMPETENCY SCALE / MOTOR VEHICLE DRIVERS

Key	**Test Points**	**Percentage**	**Mean Crash Frequency Rate Per Million Miles**	**Significance**
DPT				
	165-200	83-100	2.97	Excellent Functional Skills.
	139-164	70-82	4.16	Above Average Functional Skills.
	103-138	52-69	14.36	Average Functional Skills.
	84-102	42-51	36.79	Below Average Functional Skills.
	50-83	25-41	63.05	Poor Functional Skills.
Search				
	35-40	88-100	3.81	Excellent Search Skills.
	29-34	73-87	7.17	Above Average Search Skills.
	21-28	53-72	15.40	Average Search Skills.
	15-20	38-52	41.15	Below Average Search Skills.
	0-14	0-37	79.83	Poor Search Skills.
Identify				
	37-40	93-100	4.17	Excellent Identify Skills.
	33-36	83-92	6.23	Above Average Identify Skills.
	23-32	58-82	17.23	Average Identify Skills.
	18-22	45-57	29.93	Below Average Identify Skills.
	0-17	0-44	47.17	Poor Identify Skills.

Table 2.3 (continued)

Key	**Test Points**	**Percentage**	**Mean Crash Frequency Rate Per Million Miles**	**Significance**
Predict				
	33-40	83-100	5.23	Excellent Predict Skills.
	26-32	65-82	7.73	Above Average Predict Skills.
	16-25	40-64	15.37	Average Predict Skills.
	11-15	28-39	29.65	Below Average Predict Skills.
	0-10	0-27	33.27	Poor Predict Skills.
Decide				
	30-40	75-100	3.01	Excellent Decide Skills.
	25-29	63-74	4.71	Above Average Decide Skills.
	17-24	42-62	13.08	Average Decide Skills.
	12-16	30-41	39.19	Below Average Decide Skills.
	0-11	0-29	74.14	Poor Decide Skills.
Execute				
	31-40	78-100	1.16	Excellent Execute Skills.
	26-30	65-77	4.41	Above Average Execute Skills.
	19-25	48-64	14.77	Average Execute Skills.
	13-18	33-47	29.11	Below Average Execute Skills.
	0-12	0-32	37.17	Poor Execute Skills.

Source: Weaver, J. K. (1996). *Driver Performance Test II*. (p.8).

As shown in Table 4.1, all participants' scores were analyzed using a Two-Way Between-Groups ANOVA producing a Mean, Standard Deviation, F value, and a P value. Since the DPT is composed of SIPDE, the results are displayed for each of the five components and a DPT total. The mean scores allow the researcher to classify what the participants crash frequency rate per million miles driving would be according to Weaver. Analysis showed a significant increase in traditional and online participants' DPT scores, and a significant difference between traditional students and online students in Deciding and Executing components.

Table 4.2

COMPARISON OF PRE AND POST DPT SCORES ACROSS ALL PARTICIPANTS

Course Component	Pre-Test		Post-Test		Pre/Post	
	Mean	*SD*	Mean	*SD*	*f*	p-value
DPT	136.06	*20.90*	142.14	*18.14*	*4.13*	.04
Searching	27.22	*7.06*	28.39	*5.24*	*1.37*	.24
Identifying	30.26	*5.81*	30.97	*5.56*	*.50*	.48
Predicting	24.24	*5.36*	25.44	*4.33*	*2.78*	.10
Deciding	26.81	*6.48*	28.47	*6.53*	*2.66*	.11
Executing	27.53	6.05	28.92	5.79	*2.24*	.14

When comparing all participants' scores, the majority of scores improved. However, traditional participants' searching and predicting scores decreased but not significantly. DPT Total scores for Traditional and Online students significantly increased, as well as online deciding and executing scores. Mean Crash Frequency Rate per Million Miles driven and the significance levels were defined by Weaver during his original study. However, while the data may have shown increased scores, the data falls in the rating levels as depicted in the significance column Table 4.3.

TABLE 4.3

COMPARISON OF PRE AND POST DPT CRASH FREQUENCY RATE AND SIGNIFICANCE LEVEL

	Pre-Test		Post-Test	
Course Component	Mean Crash Frequency Rate Per Million Miles	Significance	Mean Crash Frequency Rate Per Million Miles	Significance
DPT	14.36	Average	4.16	Above Average
Searching	15.40	Average	15.40	Average
Identifying	17.23	Average	17.23	Average

Table 4.3 (continued)

	Pre-Test		Post-Test	
Course Component	Mean Crash Frequency Rate Per Million Miles	Significance	Mean Crash Frequency Rate Per Million Miles	Significance
Deciding	4.71	Above Average	4.71	Above Average
Executing	4.41	Above Average	4.41	Above Average

Results of this study stratified by delivery can be found in Appendix F. There were a total of 81 students who participated in the TRS 235 course, 42 traditional students and 39 online students. Out of the 81 student records, 80 records were complete. One of the 39 online student records was incomplete. The 80 complete records that were used in the final analysis were composed of 72 male students and 8 female students. The incomplete record indicated the following: DPT pre-test score of S = 23, I = 25, P = 24, D = missing, E = missing, was missing the personality type, and indicated that the participant was male.

TABLE 4.4

PARTICIPANTS BY DELIVERY

Records	Traditional	Online	Total
Total Records	42	39	81
Complete Records	42	38	80
Incomplete	0	1	1

Although the population was not large enough to compare males and females in traditional and online delivery formats, it is important to know of whom the population is composed. The data provided by TSI revealed that all participants identified their gender except one of the online participants. The following table displays the breakdown of the participants by delivery type and gender.

Further results show that there was a significant difference between the traditional classroom participant scores (pre-test mean 133.9, post-test mean 137.4) and online participant scores (pre-test mean 138.45, post-test mean 147.37). Therefore the research rejects the second null hypotheses of: The delivery method (traditional classroom vs online) did not affect the improvement of the visual and perceptual skills who participated in the course.

TABLE 4.5

PARTICIPANTS BY GENDER AND DELIVERY

Gender	Traditional	Online	Total
Male	41	31	72
Female	1	7	8
Unknown	0	1	1

In addition to gender when looking at the population, it is important to identify as much of the participants' demographics as possible. Due to the low sample size, inferential comparing analysis the individual personality types was not performed. Although no inferential analysis was performed regarding personalities, descriptive statistics indicated the traditional students' personality types were weighed heavily toward Peaceful (n=18) and Powerful (n=18). Online student personality types were fairly spread relatively equal among Peaceful (n=13), Powerful (n=11), and Perfect (n-10). Overall the Peaceful and Powerful personalities composed approximately 74 percent of the population included in this study. Table 4.5 displays the participants by delivery type and personality.

TABLE 4.6

PARTICIPANTS BY PERSONALITY AND DELIVERY

Personality	Traditional	Online	Total
Peaceful	18	13	31
Popular	5	4	9
Powerful	18	11	29
Perfect	1	10	11
Unknown	0	1	1

Tables 4.7 and 4.8 show the mean scores for participants Pre and Post DPT scores disaggregated by gender and personality. There was only one female student who participated in the Traditional TRS 235 course. That participant was classified as having a Peaceful Personality. With no female participants classified as Popular, Powerful, or Perfect Personalities the mean scores did not change from male participants to the total mean scores for traditional students. In Table 4.8 no female participants were classified as having a Perfect Personality, thus the mean score for male participants was the mean score for the total online participants who were classified as having Perfect Personalities.

TABLE 4.7

Traditional Mean Pre and Post DPT Scores by Gender and Personality

	Traditional Classroom					
Personality	Male		Female		Total	
	Pre	Post	Pre	Post	Pre	Post
Peaceful	133.53	139.12	152	175	134.56	141.11
Popular	134.22	137.44			134.22	137.44
Powerful	146	139			146	139
Perfect	128	123.60			128	123.60

TABLE 4.8

Online Mean Pre and Post DPT Scores by Gender and Personality

Personality	Online					
	Male		Female		Total	
	Pre	Post	Pre	Post	Pre	Post
Peaceful	129.18	144.36	127	146.5	128.85	144.69
Popular	142.18	144.9	141	157	142.18	146
Powerful	146.5	154.83	130.4	149.8	139.9	152.9
Perfect	155.75	146			155.75	146

Table 4.8 shows the number of students who achieved the significance level that was assigned by Weaver. Weaver's classification chart can in found in Table 4.1. Students who scored 165-200 achieved an excellent functional skills, 139-164 achieved an above average functional skills, 103-138 achieved an average functional skills, 84-102 achieved below average functional skills, and 50-83 achieved a poor functional skills significance level. One online record was not included as the record was incomplete.

TABLE 4.9

Mean Pre and Post DPT Scores by Weaver's Significance Levels

Significance According to Weaver	Pre-Test		Post-Test	
	Online	Traditional	Online	Traditional
Excellent Skills	0	0	2	1
Above Skills	22	20	28	25
Average Skills	15	18	7	14
Below Skills	0	3	1	2
Poor Skills	1	1	0	0

CHAPTER V

DISCUSSION AND IMPLICATIONS

The primary goals of this study were to determine the effective of the TRS 235 Emergency Vehicle Operations Course upon the participant's visual and perceptual skills. In doing so, the two research questions were as follows:

1. Does the vehicle operations courses titled TRS 235 improve the visual and perceptual skills of a student who participated in the course?
2. Does the delivery method (traditional classroom vs online) affect the improvement of the visual and perceptual skills of a student who participated in the course?

After examining the results of the study the researcher was able to reject both of the null hypotheses. The null hypotheses were as follows:

1. TRS 235 does not affect the visual and perceptual skills of students who participated in the course.
2. The delivery method (traditional classroom vs online) did not affect the improvement of the visual and perceptual skills who participated in the course.

The results also showed a significant difference between the delivery methods of online and the traditional courses, with online participants scoring higher than the traditional participants. Analysis showed a significant increase in traditional and online participants' DPT scores, and a significant difference between traditional students and online students in Deciding and Executing components.

There were two components, Searching and Predicting, which the Traditional participants' scores decreased from pre-test to post-test. It is important to remember that TRS 235 was not specifically designed around the visual and perceptual skills, although both delivery formats of TRS 235 did make significant improvements in the participants' visual and perceptual skills. Because TRS 235 was not designed with the sole purpose of improving the students' visual and perceptual skills, it can be expected that not every aspect of the visual and perceptual skills would be impacted equally by course participation. This disconnect between TRS 235 and the DPT helps explain Table 5.1. For instance, personal experience most likely pays a factor in the predicting component, as participant prediction ability is built upon what they have experienced. As students enter the course with different experience, most students would enter with different strengths and weaknesses. It is also important to understand that this study does not attempt to determine the success rate of the course in academic value. There are several aspects of the course that would not affect the participants' visual and perceptual skills. Aspects of the course that would not affect the participants' visual and perceptual skills include but are not limited to: state or federal laws and regulations, department policies and procedures. Additionally, the videos and questions posed in the DPT are not constant in driving environments. As driving environments are ever changing the visual and perceptual techniques, SIPDE, are critical concepts.

After further analysis of the two components Searching and Predicting, on which the traditional participants' scores don't significantly decreased; the online participants' Searching and Predicting components increased the most. Although each video pertained to a driving environment, it is possible that online students are better equipped to search a computer monitor and predict what will happen due to the nature that the videos are in a computer format. The following table displays the point difference between pre and post-test mean scores for traditional and online delivery formats. The DPT score is a combined total of the searching, identifying, predicting, deciding, and executing components. In reviewing the following table, one should note that all points were rounded to second decimal points.

TABLE 5.1

DIFFERENCE BETWEEN PRE/POST SCORES BY DELIVERY

Course Component	Traditional	Online
DPT Total	3.5*	8.92*
Searching	-.22	2.68
Identifying	.67	.63
Predicting	-.17	2.71
Deciding	1.65	1.68*
Executing	1.57	1.21*

* Significant at .05 level

A possible conclusion for this is that students who participated in the online format may have been accustomed to searching the monitor and predicting what will happen in videos. Traditional campus students may be unfamiliar with searching computer monitors. Another possibility, although this study was unable to exam demographics of the students, the online participants may have been older than the traditional participants. This would suggest that the online participants have more experience than the traditional participants.

<u>Recommendations for Future Research</u>

Numerous studies have found relationships between participants' performance and the participant's demographics. Such demographics include the driver's gender, age, personality, income level, and socioeconomic status. While this study reports descriptive statistics on the participants' personality types and gender, the study was not able to run inferential tests to compare these groups due to insufficient sample sizes. The study did not include driver's age, income level or socioeconomic level, since these data are not being collected by TSI.

Given the above limitations, one recommendation for the future would be to replicate this study with a larger sample size. With a larger sample size, it could be possible to compare all students' scores to test for differences by student demographics overall and within the types of course delivery.

As noted above, while this study included the reporting of the participants' personalities, the number of participants was not large enough to include an inferential analysis of pre and post-test scores for each personality type. For example, as depicted in Littauer's (2006) book *Wired That Way*, there are four personalities including Popular Sanguine, Peaceful Phlegmatic, Powerful Choleric, and Perfect Melancholy. If a difference in scores between the personality types can be found, training could be developed to specifically work with participants with different personalities.

Another recommendation would be to perform a comparison study between TRS 235 and TRS 233. Although the two courses are not composed of the same material, the results could distinguish how the courses affect the participant's visual and perceptual skills. The primary similarities and differences between the two courses are reported in Table 5.2.

TABLE 5.2

DIFFERENCES BETWEEN TRS 233 AND TRS 235

	TRS 233	TRS 235
Title	Emergency and Defensive Driving Techniques	Emergency Vehicle Roadway Operations Safety
College Credit Hours	3	3

Table 5.2 (continued)

	TRS 233	TRS 235
Enrolment	Free Elective	Only Fire Science Administration Majors
Course Focus	Emergency and Defensive Driving Skills	Defensive Driving related to Emergency Vehicles
Driver Performance Test Administered	Yes	Yes
Offered on Campus	Yes	Yes
Offered Online	No	Yes

Another recommendation would be to conduct a qualitative study across universities and training facilities with similar programs to assess what features of the course participants find beneficial or not and why. The final recommendation, much like the final recommendation of *The Effectiveness of an Emergency and Defensive Driving Techniques Course Component: Analyzing Student Response to Searching, Identifying, Predicting, and Executing Skills*, by Millard, would be to obtain the Driver History Records of the participants included in this study and correlate the number of collisions with their DPT Scores at different points in time. Potential results of this further analysis could assess how long the TRS 235 training influences the participants' driving ability.

Recommendations for Practice

Given that participants showed increased scores on the DPT in the traditional and online class and students in the online class actually outperformed those in the traditional class, these results should make those concerned with using online delivery to develop such hand-on skills as those assessed in this study more comfortable. Online courses will provide greater access especially to those in isolated areas and can be delivered more cost effectively.

Second, while this study only reported descriptive statistics by personality type, preliminary evidence suggests courses may be tailored differently for different types. The Perfect Personality is strong in planning, understanding and explanations. This personality has difficulty with distractions, offending others, and giving the impression of having superior intelligence. This would indicate the participant has the mindset of knowing everything and is not willing to accept what others are telling them. Training exercises to assist this personality would involve putting them in situations that demonstrate that their theories do not always work. TRS 235 accomplishes this with the utilization of the AutoControl Monster (ACM). The ACM is an apparatus that puts a front drive vehicle in constant oversteer.

The Powerful Personality is strong in leadership and motivation of others. This personality also has difficulty with overpowering and intimidating others. This would indicate that the participant would have difficulty handling steering techniques, and acceleration and deceleration of the vehicle. While the ACM would help to reinforce proper steering technique and acceleration/deceleration technique, range exercises Dry Skills I and Dry Skills II would help to inforce different steering techniques.

The Peaceful Personality's strongest ability is supporting the group while remaining calm and relaxed. This personality also struggles with the appearance of being monotone or lazy. This would indicate the participant has difficulty with quick responses. Training to assist this personality involves Dry Skills I and Dry Skills II. More specific exercises such as T-Turn, Figure Eight and Evasive Maneuvers would help to quicken response times.

The Popular Personality is a creative person and has the easiest time adjusting to new or different methods of accomplishing tasks. This personality also has a difficult time with remembering tasks and is easily distracted. Training to assist this personality would be a combination of all lab exercises. An example of specific exercises would include ACM exercises and Skid Pad exercises. The ACM enforces targeting skills and the vehicle control sequence. The Skid Pad exercises repeat the ACM exercises while giving a more realistic training environment.

Finally, while safety was not a primary focus of this work, using Weaver's previous findings indicates that participating in the traditional or on-line delivery of this course resulted in DPT scores correlated with reduced crash frequencies. Thus, the course may lead to saving lives and reduced insurance premiums.

Closing

In conclusion, TRS 235 significantly improved participants' visual and perceptual skills when comparing the DPT totals scores. The results of this study indicated that the pre to post-test total scores increased significantly in the online and traditional course delivery formats. This study also determined that there was a significant difference between the efficacy of online and traditional delivery with online participants scoring higher than the traditional participants. It is important to note that this study does not examine the actual physical performance of the participants' driving skills or behavior.

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Appendixes

Appendix A

Request for Participant Data Records

EASTERN KENTUCKY UNIVERSITY
Serving Kentuckians Since 1906

Kentucky Motorcycle Program
Department of Safety & Security
www.RideKY.net

220 Stratton Building
521 Lancaster Avenue
Richmond, KY 40475

TO: Dr. Tom Schneid

FROM: Christopher Millard
Assistant Director & State Coordinator

DATE: February 16, 2016

RE: Request for TRS 235, Participant Driver Performance Test Data

Dr. Dotson,

The study I am conducting for my Doctoral Dissertation is on the Visual and Perceptual Skills component of Eastern Kentucky University's TRS 235: Emergency Vehicle Roadway Operation Safety course. The results of this study will determine any change a participant's visual and perceptual skills have encountered, as a result of participating in the TRS 235 course.

I am requesting the following data from all TRS 235 on-campus and online courses:

- Individual Search, Identify, Predict, Decide, Execute Pre-Test Scores
- Total Pre-Test Score
- Individual Search, Identify, Predict, Decide, Execute Post-Test Scores
- Total Post-Test Score
- Gender
- Personality

If a participant has multiple records, please only include the most recent record. Please include all incomplete records. **Please remove all personal identification information and assign each record with a generic unique identification number.**

Thank You

Christopher Millard

Appendix B

Concept Map

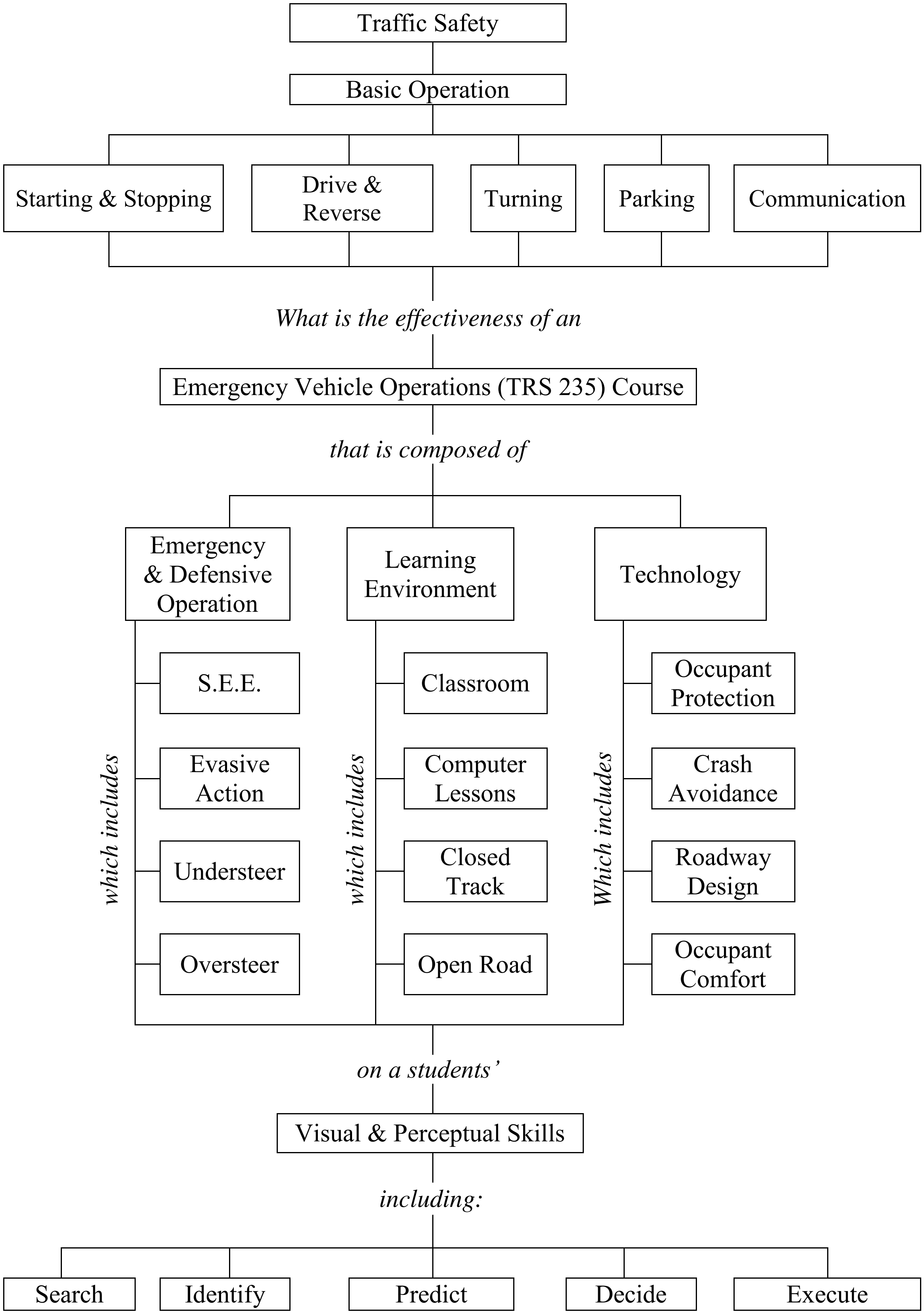

Figure 16: Concept Map.

Appendix C

TRS 235 Traditional and Online Course Objectives

TRS 235 Course Objectives

1. State the characteristics of risk in regard to reduced-risk driving performance and behavior responding to and from emergency scenes in both emergency vehicles and privately owned vehicles.
2. Relate state statutes in regard to emergency vehicle operations.
3. Identify the role of vision and perception in developing habits for reduced-risk performance and behavior responding to and from emergency scenes in both emergency vehicles and privately owned vehicles.
4. Utilize a driving strategy which provides a systematic approach to managing visibility, space and time when operating both emergency vehicles and privately owned vehicles.
5. Identify the ventral space area and utilize mirror techniques to reduce mirror blind zones for emergency vehicles and privately owned vehicles.
6. Identify and utilize kinesthetic feedback for stabilizing vehicle dynamics in relation to the laws of motion for emergency vehicles and privately owned vehicles.
7. Describe and demonstrate vehicle communication and positioning techniques for developing reduced-risk driving performance and behavior.
8. Identify and compare modern vehicle technology with older vehicle technology components in both emergency vehicles and privately owned vehicles.
9. Describe and demonstrate vehicle speed control techniques for reduced-risk driving performance and behavior when responding to and from emergency scenes in both emergency vehicles and privately owned vehicles.
10. Describe and demonstrate four steering principles which affect vehicle weight transfer and traction in both emergency vehicles and privately owned vehicles.
11. Describe and demonstrate four braking techniques which affect vehicle weight transfer and traction in both emergency vehicles and privately owned vehicles.
12. Describe and demonstrate three acceleration techniques which affect vehicle weight transfer and traction in both emergency vehicles and privately owned vehicles.
13. Recognize and respond to traction loss situation in both emergency vehicles and privately owned vehicles.
14. Recognize and respond to a vehicle in understeer and oversteer situations in both emergency vehicles and privately owned vehicles.
15. Identify and demonstrate proper maintenance procedures for emergency response vehicles.
16. Identify potential physical and psychological characteristics which may lead to high risk acceptance for a driver using either emergency vehicles or privately owned vehicles.
17. Identify potential drug-induced physical and psychological characteristics which may lead to high risk acceptance.
18. Analyze personal driving practices and develop a plan to enhance personal driving skills when operating emergency response vehicles and privately owned vehicles.

Source: *LaCount, S. (2016, March 03).* TRS 235 - Emergency Vehicle Roadway Operations Safety Syllabus. *Reading presented in Eastern Kentucky University, Richmond.*

Appendix D

List of Abbreviations

List of Abbreviations

Antilock Braking System	ABS
Control Students	CS
Department of Transportation	DOT
Driver Performance Analysis System	DPAS
Driver Performance Test	DPT
Federal Emergency Management Agency	FEMA
Identify, Predict, Decide, Execute	IPDE
International Fire Services Training Association	IFSTA
Line of Sight	LOS
Miles Per Hour	MPH
National Safety Council	NSC
Path of Travel	POT
Pre-Driver License	PDL
Search, Evaluate, Execute	SEE
Search, Identify, Predict, Decide, Execute	SIPDE
Safe Performance Curriculum Training	SPC
Statistical Product and Service Solutions	SPSS
Standard Operating Guidelines	SOG
Standard Operating Procedures	SOP
Traffic Safety	TRS
Traffic Safety Institute	TSI
TRS 235: Emergency Vehicle Roadway Operations Safety	TRS 235
Vehicle Finance Information Services	VFIS

Appendix E

Driver Performance Test / Driver Competency Scale / Motor Vehicle Drivers

TABLE 2.3

DRIVER PERFORMANCE TEST / DRIVER COMPETENCY SCALE / MOTOR VEHICLE DRIVERS

Key	Test Points	Percentage	Mean Crash Frequency Rate Per Million Miles	Significance
DPT				
	165-200	83-100	2.97	Excellent Functional Skills.
	139-164	70-82	4.16	Above Average Functional Skills.
	103-138	52-69	14.36	Average Functional Skills.
	84-102	42-51	36.79	Below Average Functional Skills.
	50-83	25-41	63.05	Poor Functional Skills.
Search				
	35-40	88-100	3.81	Excellent Search Skills.
	29-34	73-87	7.17	Above Average Search Skills.
	21-28	53-72	15.40	Average Search Skills.
	15-20	38-52	41.15	Below Average Search Skills.
	0-14	0-37	79.83	Poor Search Skills.
Identify				
	37-40	93-100	4.17	Excellent Identify Skills.
	33-36	83-92	6.23	Above Average Identify Skills.
	23-32	58-82	17.23	Average Identify Skills.
	18-22	45-57	29.93	Below Average Identify Skills.
	0-17	0-44	47.17	Poor Identify Skills.
Predict				
	33-40	83-100	5.23	Excellent Predict Skills.
	26-32	65-82	7.73	Above Average Predict Skills.
	16-25	40-64	15.37	Average Predict Skills.
	11-15	28-39	29.65	Below Average Predict Skills.
	0-10	0-27	33.27	Poor Predict Skills.
Decide				
	30-40	75-100	3.01	Excellent Decide Skills.
	25-29	63-74	4.71	Above Average Decide Skills.
	17-24	42-62	13.08	Average Decide Skills.
	12-16	30-41	39.19	Below Average Decide Skills.
	0-11	0-29	74.14	Poor Decide Skills.
Execute				
	31-40	78-100	1.16	Excellent Execute Skills.
	26-30	65-77	4.41	Above Average Execute Skills.
	19-25	48-64	14.77	Average Execute Skills.
	13-18	33-47	29.11	Below Average Execute Skills.
	0-12	0-32	37.17	Poor Execute Skills.

Source: Weaver, J. K. (1996). *Driver Performance Test II*. (p.8).

Appendix F

Comparison of Pre and Post DPT Scores

TABLE F.1

COMPARISON OF PRE AND POST DPT SCORES

Course Component	Traditional		Online		All Delivery Methods		*Time Pre/Post*	*Delivery*
	Pre-Test Mean (*SD*)	Post-Test Mean (*SD*)	Pre-Test Mean (*SD*)	Post-Test Mean (*SD*)	Pre-Test Mean (*SD*)	Post-Test Mean (*SD*)	*f* (*p* - value)	*f* (*p*-value)
DPT	133.90 (22.86)	137.40 (19.66)	138.45 (18.51)	147.37 (14.86)	136.06 (20.90)	142.14 (18.14)	4.13 (.04)	5.63 (.02)
Searching	27.79 (5.52)	27.57 (7.10)	26.61 (8.48)	29.29 (5.07)	27.22 (7.06)	28.39 (5.24)	1.37 (.24)	.07 (.80)
Identifying	29.45 (6.28)	30.12 (6.66)	31.16 (5.17)	31.79 (4.75)	30.26 (5.81)	30.97 (5.56)	.50 (.48)	3.37 (.07)
Predicting	24.48 (5.29)	24.31 (4.59)	23.97 (5.49)	26.68 (3.68)	24.24 (5.36)	25.44 (4.33)	2.78 (.10)	1.50 (.22)
Deciding	25.71 (6.38)	27.36 (7.70)	28.03 (6.46)	29.71 (4.72)	26.81 (6.48)	28.47 (6.53)	2.66 (.11)	5.24 (.02)
Executing	26.48 (6.44)	28.05 (6.31)	28.68 (5.44)	29.89 (5.08)	27.53 (6.05)	28.92 (5.79)	2.24 (.14)	4.76 (.03)