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School of Transportation Sciences

Master of Transportation Sciences

Master's thesis

Developing an e-learning module for paratransit and bus rapid transit (BRT) drivers in the Nairobi metropolitan area in Kenya

Nancy Njeri Mburu
Thesis presented in fulfillment of the requirements for the degree of Master of Transportation Sciences

SUPERVISOR :
Prof. dr. Gerhard WETS

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Developing an E-learning module for Paratransit (Matatu) and Bus Rapid Transit (BRT) drivers in the Nairobi Metropolitan Area, Kenya

Supervisor:

Prof. dr. Gerhard WETS

Co-supervisor:

Lien AERTS

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Nancy Njeri Mburu

This Thesis is presented in partial fulfillment of the requirements for the degree of Master of Transportation Sciences.

Acknowledgments

This thesis is submitted as part of my completion of the Master of Transportation Studies at Hasselt University. The research topic was motivated by my work in developing a training program for public transport operations for the Nairobi Metropolitan Area Transport Authority (NaMATA). I am passionate about improving road safety in Kenya and believe that continuous training for public transport drivers will improve driver behavior, thus reducing fatalities and severe injuries on Kenyan roads. Though this project focuses on public transport drivers in the Nairobi Metropolitan Area (NMA), the E-learning course can be scaled up to cover the whole country and the East African region.

I thank the almighty God for taking me through this program in good health. I also acknowledge and appreciate the following people who supported me during my research;

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May God bless you all.

Nancy Njeri Mburu

20 May, 2023

Abstract

Kenya is losing over 4000 people to road crashes annually (NTSA, 2022). Studies indicate that matatus are involved in almost half of road traffic crashes resulting in severe injuries and deaths (Raynor & Mirzoev, 2014). Most crashes are attributed to human error (Ontario Ministry of Transport (OMT), 2003). Drivers need to be continually trained to enhance their safe driving skills.

Driver curriculum in Kenya focuses on pre-license training overlooking the need for continuous post-license training. This study aims to develop an online course for Matatu and future BRT drivers in the Nairobi Metropolitan Area (NMA) to enhance driver knowledge and skills for a safer and more efficient public transport system. The online course will be personalised and readily accessible through a mobile phone to enable drivers to train at any location whenever they have free time.

Secondary and primary data were collected to inform the design of the E-learning course. The researcher reviewed relevant literature to obtain information on learning theories, online training, and driver training. The researcher collected primary data from two categories of matatu operators: nine paratransit/matatu and the second one, 39 drivers.

All the drivers who responded to the survey were males; the majority were between 30 to 39 years. The study revealed that over 90 percent of the drivers have smartphones, and 80 percent access the internet through data bundles purchased from internet providers. The priority training needs include road safety, vehicle maintenance, and emergency response. Motivations for training include; improving driver road safety record, Certificate of completion, and better job opportunities. Over 90 percent of drivers want to learn about Bus Rapid Transit (BRT).

Informed by the primary and secondary data, the researcher designed a micro-learning course for public transport drivers with three levels/modules: BRT, Road Safety, and Emergency Procedures. The researcher recommends the adoption of the Mobile-based E-learning course to close the gap for post–license continuous training for public transport drivers in Kenya, among other recommendations.

Keywords

E-learning, road safety, Nairobi Metropolitan Area, BRT, matatu drivers, Internet, Training,

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List of abbreviations

BRT	Bus Rapid Transit
ARSO	Africa Road Safety Observatory
BRT	Bus Rapid Transit
CAT	Continuous Assessment Test
CIDPs	County Integrated Development Plans
CMS	Course Management systems
CPD	Continuous Professional Development
DL	Driving License
DN	Daily Nation
EU	European Union
GDLs	Graduated Driving licenses
GDP	Gross Domestic Product
GOK	Government of Kenya
GRSF	Global Road Safety fund
ICT	Information and Communications Technology
ICT	Information and Communications Technology
IDS	Institute for Development studies
ITDP	Institute for Transportation and Development Policy
JICA	Japan International Corporation Agency
KBSM	Kenya Bus Service Management
KES	Kenya Shilling
KNBS	Kenya National Bureau of Statistics
KPS	Kenya Police Service
LANs	Local Area Networks
LMICs	Low and Middle-Income Countries
LMS	Learning Management Systems
MOA	Matatu Owners Association
MOOC	Massive open online course
MORT	Ministry of Roads and Transport

MRTS	Mass Rapid Transit System
NaMATA	Nairobi Metropolitan Area Transport Authority
NCC	Nairobi City County
NMA	Nairobi Metropolitan Area
NMT	Non-motorized Transport
NTSA	National Transport and Safety Authority
OMT	Ontario Ministry of Transport
PDAs	Personal digital assistants
PSV	public service vehicles
PWD	Persons with disability
RPM	Rotations per Minute
RTA	Road Traffic Accidents
RTC	Road traffic crashes
SACCO	Savings and Credit Cooperation Organisation
SCT	Social Cognitive Theory
SDGs	Sustainable Development Goals
TPMS	Tire pressure monitoring system
VLEs	Virtual Learning Environments
WB	World Bank
WHO	World Health Organisation
WRI	World Resources Institute

1   Introduction

1.1   Background and Rationale for the Study

WHO estimates that about 1.35 million people die on global roads annually, becoming the eighth cause of death for all ages and the leading cause for children aged 5 to 14 years and young adults aged 25 to 29 years (World Health Organisation (WHO), 2018). In addition, about 50 million people suffer severe and life-changing injuries (WHO,2018). The often overlooked road users, including pedestrians, motorcyclists, and cyclists, are the most heavily impacted by road crashes. Ninety percent of fatalities due to road traffic crashes (RTC) happen in low- and middle-income countries; unfortunately, the problem is worsening. With only 52 percent of global registered vehicles and 72 percent of the world population, developing countries carry a disproportionate number of road traffic crashes at 80 percent (Manyara, 2016).

For most African countries, road traffic injuries and fatalities remain one of the biggest yet preventable health and economic issues (Africa Road Safety Observatory (ARSO), 2021). Africa reports the highest fatality rate due to road crashes, with 26.6 road fatalities per 100,000 populations, compared with a global average of 17.5 per 100,000 and 9.3 per 100,000 in Europe (WHO, 2018). Traffic crashes are ranked as the ninth cause of death in the continent, with approximately 296,000 residents dying on the road every year due to road traffic crashes (ARSO, 2021). Poor road safety in Africa heavily impacts the residents due to the death and misery it causes and the loss of productivity due to severe injuries (ARSO,2021).

With an estimated annual fatality rate of 34.4 per 100,000 populations, Kenya is ranked among the top riskiest country in the world (Imanyara, 2016). The nature of crashes in the country varies depending on whether the land use is rural or urban. Pedestrians are more vulnerable in urban set-ups, while in rural areas, most fatalities are road traffic passengers killed in crashes along the trunk highways (Odero, Khayesi & Heda, 2010). According to National Transport and Safety Authority (NTSA), Kenya lost 4,271 and 4,432 people to road crashes in 2021 and 2022, respectively, with the majority of the fatal crashes happening in the City-County of Nairobi (NTSA, 2022). The NTSA road crash data for 2021 and 2022 further indicates that 34 percent and 36 percent of road fatalities were pedestrians. Unfortunately, over 75 percent of the Kenyans dying on the roads are young and economically productive (NTSA, 2022, Odero et al., 2010, Manyara, 2016).

 "Road traffic injury prevention is not a transport challenge; it is a development challenge with a strong impact on health, wellbeing, and economic growth" (World Bank, 2018). Road fatalities and serious injuries are the highest cost in road crashes, costing countries 3 to 5 percent of their Gross Domestic Product (GDP) due to related costs, including; healthcare expenses, emergency response services, loss of breadwinners, loss of skilled workers, reduced productivity, damage to assets among others (WB, 2018, WB, 2019). In 2014, World Health Organisation (WHO) estimated Kenya's annual loss due to road crashes to be approximately 5 percent of its GDP, amounting to Kenya Shilling (KES) 387.5 Billion, with the figure projected to grow (Daily Nation (DN), 2018). World Bank (2018) revealed that a reduction by half in road crash injuries could lead to an increase in Gross Domestic Product (GDP) per capita of 15 to 24 percent in

24 years. Interventions by government agencies to enhance road safety should therefore be viewed as economic investments contributing to the country's GDP (World Bank, 2018).

"Road traffic safety results from a complex interaction of technical, environmental, and behavioral factors." (Perrels, Votsis, Nurmi, and Pilli-Sihvola, 2015). Various factors that cause road traffic crashes require different approaches to minimise their impacts. Some road crash causes are behavior related and can be attributed to attitude and culture. According to the Department of Transport Netherlands (2010), most road crashes attributed to human error result from incompetence, inadequate experience, substance abuse, poor eyesight, distraction, or fatigue. A study by Moraa (2006) established that most public service vehicle (PSV) drivers in Kenya have a negative attitude towards police, which affects law enforcement leading to traffic crashes. The study also established that most drivers have low morale in their work (Moraa, 2006).

Rapid urbanization and increasing motorization have resulted in growing road fatalities in the country (Muguro, Sasaki, Matsushita, and Njeri, 2020). According to a study by NTSA in collaboration with Kenya Police Service (KPS), approximately 35 percent of road crash fatalities happen within 20m from matatus/bus stages, bringing into question the deficiencies in the public transport facilities' design and the paratransit drivers' unsafe behavior. Odero et al. (2010) opined that though matatus offer an essential service, they are known to violate traffic laws resulting in traffic crashes and fatalities. Similar observations by Raynor and Mirzoev (2014) indicate that road crashes in Kenya result from many factors, with the critical cause being public transport (matatu) drivers. The study further states that though matatus are only 11 percent of the registered vehicles in Kenya, they are involved in 43.6 percent of road traffic crashes resulting in serious injuries. 70.2 percent of the RTC patients admitted in 48 hospitals studied were matatu passengers (Raynor & Mirzoev, 2014).

Some writers have argued that most road crashes are due to driver fatigue, speeding, distracted driving or walking, pedestrians crossing at undesignated locations, and drunk driving (Kimotho, 2023, Maombo, 2022). Most crashes in Kenya happen at about 8.00 pm when many vehicles and pedestrians are on the road, combined with less police presence (Maombo, 2022). Many pedestrians are hit by vehicles on poorly lit streets and crossing locations as pedestrians are not visible to drivers at night (Maombo, 2022). Studies have established that most road crashes are caused by driver error resulting from driving too fast, failure to give way, little following distance, wrong turns, or lane change (Ontario Ministry of Transport, 2003).   Drivers need to be continually trained to enhance their driving skills and make them more aware of best practices in road safety and how to avoid road crashes.

The Government of Kenya recognizes the potential of Information and Communications Technology (ICT) as an "enabler or foundation for socio-economic transformation" (Ministry of ICT, 2019). Kenya National Information and Communication Technology (ICT) Policy, 2019 envisions "Kenya as a globally competitive knowledge-based economy." The Government's mission is to facilitate access to ICT services and infrastructure throughout the country. In light of this and following heavy investments by the government in the ICT sector, 99.9 percent of Kenyans have access to the internet through mobile phones, making Kenya Africa's fastest-growing ICT market (Ministry of ICT, 2019).

With the advent of ICT, E-learning has been recognized by public officers as a critical tool for skill development in government institutions (Nisar, 2004). The Government of Kenya (GOK) is promoting the deployment of ICT in teaching and learning for primary and higher education. E-learning allows collaboration with global organizations and agencies (Barasa, 2021).

Implementation of a formal mass rapid transportation system has commenced in earnest in Nairobi, including Bus Rapid Transit (BRT) network, complemented by commuter rail and Non-Motorised Transport (NMT) facilities, as envisaged by the 2014 Mass Rapid Transit System (MRTS) Harmonisation Plan (Gauff Consultants, 2014).   However, the capacity to operate a scheduled BRT is currently lacking. Developing the required knowledge and skills for public transport operations has become necessary to address this challenge. This study focuses on designing an online driver course for the existing public service vehicle (paratransit) to develop the much-needed competence for safe and efficient public transport in the Nairobi Metropolitan Area (NMA).

This study will seek to establish strategies for developing a practical e-learning course to inform the design of the E-learning Course for paratransit and future BRT drivers in the Nairobi Metropolitan Area. Learners will be introduced to critical aspects of BRT operations and how it differs from paratransit. They will also learn about the five BRT corridors in Nairobi and current progress. Learners will also be trained to drive public transport vehicles bus safely in normal and adverse conditions. Preventive maintenance, including routine inspection and periodic maintenance, and responding to emergencies are also included in the course. The proposed online driver course will use the widely accessible mobile and internet access in the country. The online course will be personalised and easily accessible through the mobile phone so that the learners can access the training wherever they can spare some free time.

1.2   Problem statement

According to National Transport and Safety Authority (NTSA), Kenya lost 4,271 and 4,432 people to road crashes in 2021 and 2022, respectively (NTSA, 2022). In 2014, World Health Organisation (WHO) estimated Kenya's annual loss due to road crashes to be approximately 5 percent of its Gross Domestic Product (GDP), amounting to KES 387.5 Billion, with the figure expected to rise (Daily Nation (DN), 2018). Manyara (2016) argues that the total cost of road traffic crashes is more than the development aid the developing countries receive annually. A study by World Bank revealed that a reduction by half in road crash injuries could lead to an increase in Gross Domestic Product (GDP) per capita of 15 to 24 percent in 24 years (World Bank, 2018). Efforts or interventions by road agencies and other players to enhance road safety should therefore be viewed as economic investments contributing to the country's GDP (World Bank, 2018).

A study by Raynor & Mirzoev (2014) indicated that road crashes in Kenya result from many factors, with the leading cause being public transport (matatu) drivers. Though matatus are only 11 percent of the registered vehicles in Kenya, the study established that matatus were involved in 43.6 percent of the road traffic crashes resulting in severe injuries, and 70.2 percent of the RTC patients admitted in the 48 hospitals studied were matatu passengers (Raynor & Mirzoev, 2014). Moraa (2006) noted that driving schools in Kenya are not adequately monitored to ensure that the required standards are maintained. Moraa (2006) further reckons that most public service vehicle (PSV) drivers in Kenya have low morale in their work and a negative attitude towards police, which may affect law enforcement, leading to traffic crashes.

Despite the enormous social and economic burden resulting from road traffic crashes in Kenya, post-license training for paratransit drivers is missing resulting in a deteriorating safety situation on Kenyan roads. Most crashes happen in Nairobi city and its environs (NTSA,2022).

This study aims to develop a practical E-learning course for Matatu and future BRT drivers in the Nairobi Metropolitan Area (NMA) toward a safer and more efficient public transport system. The online course will be personalised and easily accessible through the mobile phone so that the targeted learners can access the training wherever they are and when they can spare some free time. The drivers will have an opportunity to study at their own pace and without having to attend physical classes. This can include learning while at the stage waiting for passengers to board the bus, during off-peak breaks, off-days, after work, and during the weekends, thus not interrupting their regular work schedule.

1.3 Scope

This study's scope included identifying training needs for public transport drivers in the Nairobi Metropolitan Area and developing an E-learning Course focusing on the identified training needs. The study also aimed to establish key motivation for the drivers to take up the training, complete, and practice what they learn to be incorporated into the training Course. The training program is designed for public transport drivers in the Nairobi Metropolitan Area, where a Bus Rapid Transit (BRT) system is expected to be commissioned in a few years.

Kenya lies on the East Coast of Africa, bordering South Sudan and Ethiopia to the North, Somalia and the Indian Ocean to the East, Tanzania to the South, and West is Uganda and Lake Victoria, covering an area of 582,646sq km (Omwenga, 2010). According to the 2019 National Census, the country has a population of 47.6 million (KNBS, 2019). For over the last decade, Kenya has experienced significant political, economic, and structural reforms resulting in economic and social development and political growth, elevating the country to a "lower" Middle Income Country (MIC) (Ogollah, Rucha, Aroni, & Ndua, 2019).

With about 27 percent of the Kenyan population living in urban areas and an urbanization rate of 4.3 percent, the Country is experiencing an early stage of urbanization (World Bank, 2016). Fifty percent of the country's population is expected to live in urban areas by 2050 (World Bank, 2016). Rapid growth in the urban population has created pressure for cities and towns due to the increasing demand for transportation services and infrastructure (Ministry of Roads & Transport (MORT), 2019).

This study focuses on the Nairobi Metropolitan area in Kenya, consisting of five counties: Nairobi City County, Kiambu, Kajiado, Machakos, and Muranga Counties. Nairobi City County has a population of 4,4 million people, while its Metropolitan area has a total of 10.4 million (Kenya National Bureau of Standards (KNBS), 2019). This region is Kenya's leading economic and cultural center and one of Africa's fastest-growing metropolitan regions, with the built-up area growing at a rate of 1.49Km2 per year (Mundia, 2017).
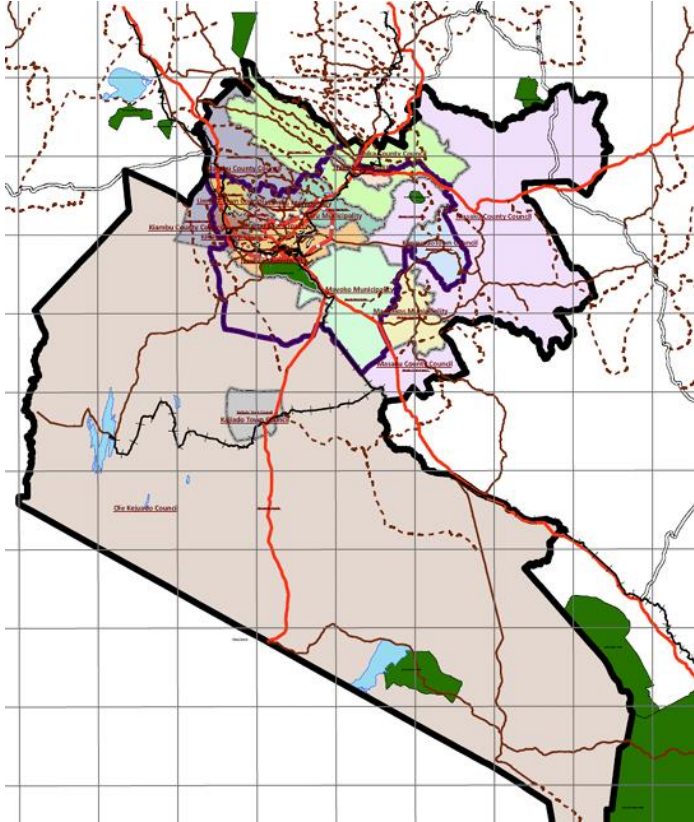
FIGURE 1 Nairobi Metropolitan Region (Source Omwenga, 2010)

TABLE 1 Nairobi Metropolitan Area population (KNBS, 2019).

County	Population
Nairobi City County	4,397,073
Muranga	1,056,640
Kiambu	2,417,735
Kajiado	1,117,840
Machakos	1,421,932
Total	**10,411,220**

1.4   Research objectives/research questions

Studies have established that most road crashes are caused by driver error resulting from driving too fast, failure to give way, little following distance, wrong turns, or lane change (Ontario Ministry of Transport, 2003). Drivers, particularly public transport bus drivers, must be continually trained to enhance their driving skills and make them more aware of best practices in road safety and how to avoid road crashes. With the growing concern about the road safety situation in Kenya, there is a clear motivation to establish continuous practical training for drivers to reduce road crashes and the associated fatalities and injuries.

Through online training, paratransit and future BRT drivers can study independently without attending physical classes. This can include learning during off-peak breaks, evenings, and weekends, thus avoiding disrupting their regular work schedule. The online course will be personalised and easily accessible through the mobile phone so that the learners can access the training wherever they can spare some free time. The training flexibility, relevance to work, and a Certificate upon Course completion are key factors expected to motivate many drivers to participate and complete the training.

The objectives of this study include the following;

- To identify training needs for public transport drivers in the Nairobi Metropolitan Area;

- To identify factors that will make the training module rich, engaging, and compelling to the learner and incorporate these into the training course.

- To develop an attractive and cost-effective online training module for paratransit and future BRT drivers in the Nairobi Metropolitan area in Kenya.

1.5   Research question and sub-questions

The road safety situation in Kenya is concerning and, worse still, deteriorating. As public transport vehicles have been said to contribute significantly to crashes on the road, this study is motivated by a desire to reduce deaths and severe injuries on Kenyan roads through continuous driver training.

The main research question: What strategies can be used to develop an attractive and cost-effective online training Course for paratransit and BRT drivers in the Nairobi Metropolitan Area to enhance the safety and efficiency of the public transport system?

Sub-questions to help answer the main question included;

- How is the existing training for bus/matatu drivers structured in Kenya?

- What are the gaps in the current training and licensing for public transport drivers?

- What are the training needs that will improve driver safety skills?

- What aspects make the module rich, engaging, and compelling to the learner?

- What challenges are likely to hinder the implementation of the e-learning Course, and how can they be addressed?

1.6   Structure of Thesis

The following is a summarised description of the structure of the Thesis;

Chapter One-Introduction: provides the background information, the situational analysis, the problem statement, the scope, the objectives, and the research questions of the study. This Chapter aims to give the key research highlights detailed in the rest of this report.

Chapter Two –Literature Review: discusses three learning theories, namely, Expectancy Theory, Self-Determination Theory, and Social Cognitive Theory. The Chapter also discusses other findings from literature focusing on the relevant areas, including driver training, training curriculum for drivers in Kenya, the procedure for obtaining a driving license in Kenya, E-learning, Micro-learning, and strategies for designing a practical online course.

Chapter Three-Public Transport in Nairobi: discusses mobility in Nairobi, starting with modal share, paratransit (matatu) transport sector, Nairobi Metropolitan Area Transport Authority (NaMATA) and its functions in the provision of safe and efficient public transport and the Bus Rapid Transit (BRT) Masterplan for Nairobi.

Chapter Four-Research Design: discusses the research design, target population, sampling technique and sample size, data collection tools, and data collection process. The Chapter also explains the researcher's justification for the methods chosen for undertaking the study.

Chapter Five-Data Analysis and Findings: covers data analysis and findings, discusses how the data was processed and analyzed, and details the results from the study.

Chapter Six discusses the development of the E-learning Course and expounds on the Course Curriculum for the three modules: Module 1 on Bus Rapid Transit, Module 2 on Road Safety, and Module 3 on Emergency Procedures.

Chapter Seven, on **Discussions**, summarizes key findings, conclusions, and recommendations.

Chapter Eight discusses the study conclusions, recommendations, and limitations, course implementation, and proposes future research areas.

References are provided towards the end of the report, followed by Appendices where copies of relevant documents in the research, including the Authorization letter and Questionnaires, are appended.

2 Literature Review

2.1 Introduction

This Chapter reviews the literature on learning, delving into theories of learning, covering three theories of motivation and learning, including Expectancy, Self Determination, and Social Cognitive theories. The researcher then discusses driver training in Kenya and the various categories of driving licenses issued to public transport drivers. The Chapter also includes literature on E-learning, Micro-learning, and how to design a practical E-learning course.

2.2 Theories of Motivation and Learning

There is a strong connection between motivation and learning (Gopalan, Bakar, Zulkifli, Alwi, & Mat, 2017). Chen & Jang (2010) reckon that learner motivation should be given adequate weight to improve the completion rate in any online training. Learners' level of engagement and participation indicates their motivation to learn. An active and enthusiastic student does not need external stimulants to persuade them to learn. On the other hand, a student who lacks motivation needs encouragement through a reward system to convince them to take learning activities seriously (Gopalan et al., 2017). Most theories of motivation are based on the assumption that people will behave in a certain way and maintain that behavior if they know that the behavior will lead to desired benefits (Deci & Ryan, 2000). The researcher discusses three theories of learning, including Expectancy theory, Self-Determination theory, and Social Cognitive theory;

2.2.1 Expectancy Theory of Learning

Expectancy theory, one of the motivational principles, has helped understand the reason behind behavioral traits that pop up from different individuals in an organisation. According to (Vroom, 1964 and Porter & Lawler,1968), people take actions based on self-interest and will do things that have the highest chance of the desired results to benefit them. Expectancy theory is a process theory of motivation, focusing on a person's discernment of a situation and the resulting eventuality based on personal expectations (Isaac, Zerbe, & Pitt, 2001). According to the theory, when the results do not suit the recipient of the product, there is dissatisfaction due to the initial expectations that the individual had concerning the results acquired (Yesiilkaya and Yildiz, 2022).

Two models, the expectancy confirmation theory and the expectancy disconfirmation theory, explain the relationship between the expectations before undertaking a course and the satisfactory results a learner expects at the end of the course (Yesiilkaya and Yildiz, 2022). The expectancy confirmation paradigm is based on various variables: expectations, product, and performance. On the other hand, the expectancy disconfirmation is either positive or negative. Positive disconfirmation is when the results are higher than expected, while negative disconfirmation is when the results are lower than expected (Mehboob and Othman, 2020).

2.2.2 Self-determination Theory of Learning

Self-determination Theory indicates that human beings have an innate drive to learn, which is enhanced or suppressed by their life situation (Deci and Ryan, 2013; Deci and Ryan, 2000). At the center of self-determination theory is autonomy, which refers to the innate psychological desire to control one's actions

and decisions. Consequently, if an individual experiences autonomy, they perceive their behavior as self-endorsed rather than externally compelled, fostering intrinsic motivation and encouraging them to engage in satisfying activities (Xia et al., 2022). On the contrary, extrinsic motivation, such as rewards or punishments, are less likely to last.

Additionally, self-determination theory encourages competency, which pertains to individuals' need to feel adequate and capable in their pursuits and activities. When individuals perceive themselves as competent, they experience a sense of mastery and achievement, leading to increased self-esteem and motivation. Conversely, feelings of incompetence can undermine motivation and well-being.

Relatedness is another pillar of the theory, which refers to the need for social connections and a sense of belongingness. When individuals feel connected to others, they experience a sense of support, understanding, and validation, which enhances motivation and fosters positive relationships. Furthermore, the theory posits that the satisfaction of these three psychological needs-autonomy, competence, and relatedness-leads to optimal functioning and well-being (Luo and Yang, 2021). When individuals have the opportunities to make choices and experience a sense of autonomy, engage in activities that challenge and develop their skills, and foster meaningful connections with others, they are more likely to experience intrinsic motivation, self-determined behavior, and overall life satisfaction. Applying self-determination theory in learning can contribute to promoting individuals' psychological well-being and facilitating their personal growth.

2.2.3   Social Cognitive Theory (SCT)

Social Cognitive Theory (SCT) dates back to the 1970s when the focus shifted from behavior to cognition, with Bandura publishing his landmark self-efficacy article (Luszczynska & Schwarzer, 2015). In 1986, Bandura released a book on "*Social Foundations of Thought and Action: A Social Cognitive Theory.*" The SCT has been applied in various areas, including student performance, mental and physical health, career decisions, and emotional disorders (Luszczynska & Schwarzer, 2015). One of the fundamental concepts of Social Cognitive Theory is observational learning. According to Bandura, individuals acquire new behaviors by observing and imitating others. Through vicarious reinforcement, individuals assess the consequences of others' actions, influencing their decision to emulate or avoid such behavior.

The social cognitive theory addresses self-efficacy, which refers to an individual's belief in their ability to perform a task or behavior. Self-efficacy is crucial in motivation, goal setting, and persistence (Schunk and Di Benedetto, 2020). Individuals with high self-esteem are more likely to engage in challenging tasks and persist in facing obstacles. On the other hand, low self-efficacy may result in reduced effort and avoidance behavior. The theory discusses reciprocal determinism, which involves the dynamic interaction between personal factors, behavior, and the environment. Individuals' behavior is influenced by unique characteristics such as beliefs, environmental factors like social norms, and behavioral factors, for instance, actions. Reciprocal determinism suggests that these three factors continually interact and mutually influence each other.

Social Cognitive Theory has a significant implication in the education sector. The theory has a considerable impact on education and instructional design. Teachers can enhance learning by providing explicit models, scaffolding learning experiences, and creating opportunities for observational learning.

The Social Cognitive Theory provides a comprehensive framework for understanding human behavior and learning (Middleton and Hall et al.,2019). The theory highlights the importance of social interactions and cognitive processes in shaping behavior through its key concepts of observational learning, self-efficacy, and reciprocal determinism.

2.3 Driver training

Yendra (2021) argues that driver competence is essential for the success of a business. The writer adds that for bus operating companies, the number of crashes involving company buses can be a vital indicator of the company's performance. According to Glowalla & Schmidt, 2012), a training curriculum for new drivers should include current, safe, and environmentally friendly driving techniques and tactics to equip novice drivers to adapt to the emerging challenges in road traffic. New drivers need to fully understand their responsibility as drivers in traffic and be accountable for their own lives, those of their passengers, and other road users (Glowalla & Schmidt, 2012). Elvik, Høye, Vaa, & Sørensen (2009) have listed twelve factors that should be included in driver training, namely, the minimum age of drivers for various categories, the health status of drivers, minimum driver performance standards, basic driver training, driver testing, motorcycle driver training and testing, professional driver training, graduated driving licenses (GDLs), driver motivation and incentive programs, driver rest sessions regulation, emergency driving safety standards, school bus safety standards. Defensive training by employers and effective incentives and motivational programs have been found to improve road safety records by 20 percent (Elvik et al., 2009).

While driving is not difficult to learn, what is challenging is to simultaneously drive, read and interpret road signs, scan, and react to changing road environments yet focus on the driving. New drivers must learn to cope with these requirements, as mistakes on the road can lead to crashes resulting in fatalities or serious injuries (Glowalla & Schmidt, 2012). Glowalla and Schmidt (2012) emphasise that driver training must shift from the "one size fits all" approach to more personalised training, where it becomes necessary to understand the learners' needs and design the training accordingly.

2.4 Driver Training Curriculum for Kenya

According to NTSA (2016), "driver training aims to give the learner the proper knowledge, skills, and attitudes required to develop the necessary competence and discipline." NTSA's primary goals of driver training include;

- To establish a safe, reliable, and efficient road transport system
- To reduce road traffic crashes and associated fatalities
- To enhance compliance with traffic laws, rules, and regulations
- Promote a culture of safe roads through cautious driving with exceptional care for vulnerable road users.
- To promote vehicle roadworthiness

Like other educational systems, "driver training should be based on known pedagogical and psychological principles." The driver should be trained to competently undertake their essential road tasks, including observing, deciding, and acting. Driver training curricula should aim to build coping mechanisms for changing road traffic situations and to inculcate disciplined behavior informed by the awareness of the hazards of defensive and eco-friendly driving (NTSA, 2016).

With the realisation that over 80 percent of road crashes are caused by human error, the need to educate and develop the necessary skills for safe driving has become evident. The standard curriculum for training drivers in Kenya was created in 2012 by the Ministry of Roads and Transport (MORT) with the support of the World Bank. A revised edition was compiled by NTSA and published in 2016. The curriculum has several Modules, each focusing on different categories of drivers ranging from motorcycles, light vehicles, public service vehicles (PSV), and heavy commercial vehicles. Additional modules target drivers of plant and heavy construction and agricultural equipment. The curriculum covers theoretical and practical training and testing of newly trained drivers. All motor-vehicle drivers and motorcycle riders must undergo their respective training and undertake and pass the test before being authorised to drive on Kenyan roads. Part II of the Curriculum covers training and testing for driving instructors (NTSA, 2016).

2.5   Driver training and obtaining a Driving License (DL) in Kenya

To obtain a driving license in Kenya, one has to be 18 years or above for a motor vehicle license and 16 years for a motorbike (bodaboda). Anybody who meets the age requirement can attend an NTSA-registered driving school where they are trained to drive under the instruction of a competent and licensed driving instructor. NTSA has developed a list of approved driving schools on its website. The driving school registers its students on the NTSA Website to enable them to take the final driving test by NTSA (NTSA 2016). Driver training includes theory and practical guided by the NTSA training curriculum (NTSA 2016).

2.5.1   Theory driving lessons

NTSA requires theory lessons to be conducted in the following sequence;

a)   Introduction to driving
b)   Fundamental driving rules
c)   Model town
d)   Human factors in driving
e)   Introduction to the class of vehicle
f)   Motor vehicle parts, instruments, and controls
g)   Basic vehicle control
h)   Maneuvers on a yard under controlled traffic conditions
i)   Maneuvers on the road under all traffic conditions
j)   Specific units depending on the Module

NTSA Curriculum requires a Continuous Assessment Test (CAT) in the form of 50 multiple choice questions after a minimum of 40 hours of learning with a pass mark of 35 out of 50. The CAT mark constitutes 30 percent of the exam for issuance of a Certificate. The final theoretical test consists of the CAT given every 40hrs and the final test after all the units in a module. The learner must attend at least 90 percent of the driver training lessons, and the driving schools should maintain attendance registers for each learner. Theory training can be provided online.

2.5.2   Practical training

A learner must obtain a provisional driving license for practical lessons on a public road. Before receiving the provisional license, the learner should be tested on the first four theory units and pass. A learner who fails the test is not issued a provisional license. In addition, the learner should have received at least four

hours of practical driving in the maneuvering yard before driving on the public road. The learner is required to attend all the practical driving lessons (NTSA, 2016). The practical test comprises manoeuvre yard and road tests (NTSA, 2016).

2.5.3 Driving License and Driving test

The driving test is made up of theory and practical tests. The theoretical section consists of the CAT after 40hrs training and the final test after completing all the modules. The final examination consists of fifty multiple-choice questions. The learner is then tested on the yard and the road and should obtain a minimum score of 80 percent (NTSA, 2016).

2.5.4 Examination

Only learners who have scored an aggregate mark of 70 percent and above should be presented to NTSA for the final examination (NTSA, 2016).

2.5.5 Validity of a driver's license

A driver's license shall be renewed every year for nine years. In the tenth year, the license holder should go through a medical test and retake the test. Drivers above 70 years will be required to produce medical fitness reports after every year before their license is renewed (NTSA, 2016).

2.5.6 Public Service Vehicle Driver's license (DL)

In 2014, NTSA introduced a digital driving license, ending the issuance of manual driving licenses. Drivers are required to renew the DL after every year and to undergo medical tests after ten years. Renewal of driving license is done through eCitizen Portal.
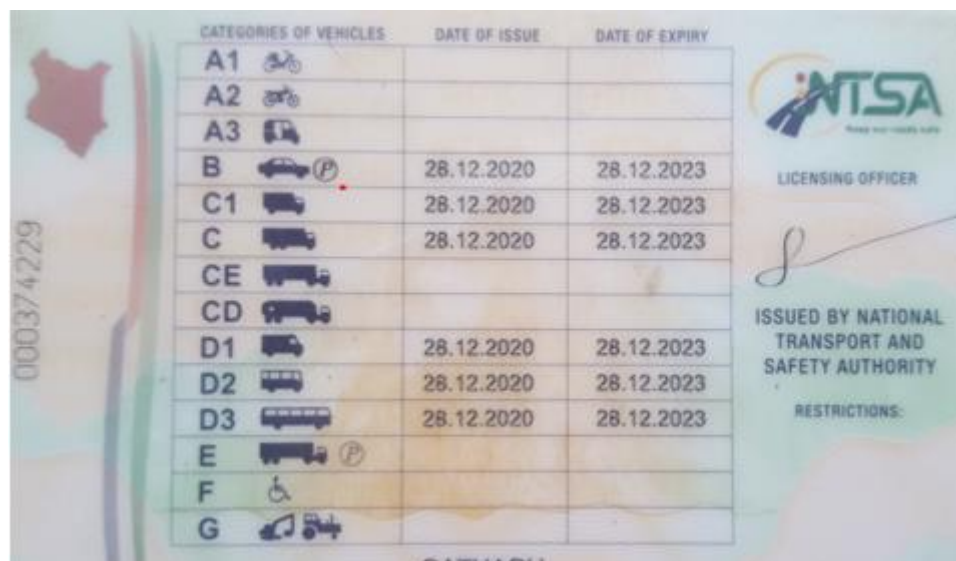
FIGURE 2 An example of a public transport vehicle driving license in Kenya

There are three categories of public transport vehicle licenses, as described below;

Category D1 (Van): The holder of the Category D1 License should be at least 22 years old and authorised to drive a 14-passenger seater (maximum) van with a manual or automatic gearbox.

Category D2 (Minibus): A class D2 license holder is authorised to operate a passenger bus with a carrying capacity of 14 to 32 passengers. The driver's minimum age is 25, with a minimum of three years of D1 driving experience. The applicant should undergo training and retesting before receiving a Category D2 license.

Category D3 (Bus driver): A Category D3 license holder can drive buses carrying 33 passengers and above with a manual or automatic gearbox. The applicant should be at least 30 years old and have at least three years of experience driving with a D2 license. The applicant should undergo training and retesting to qualify for Category D3.
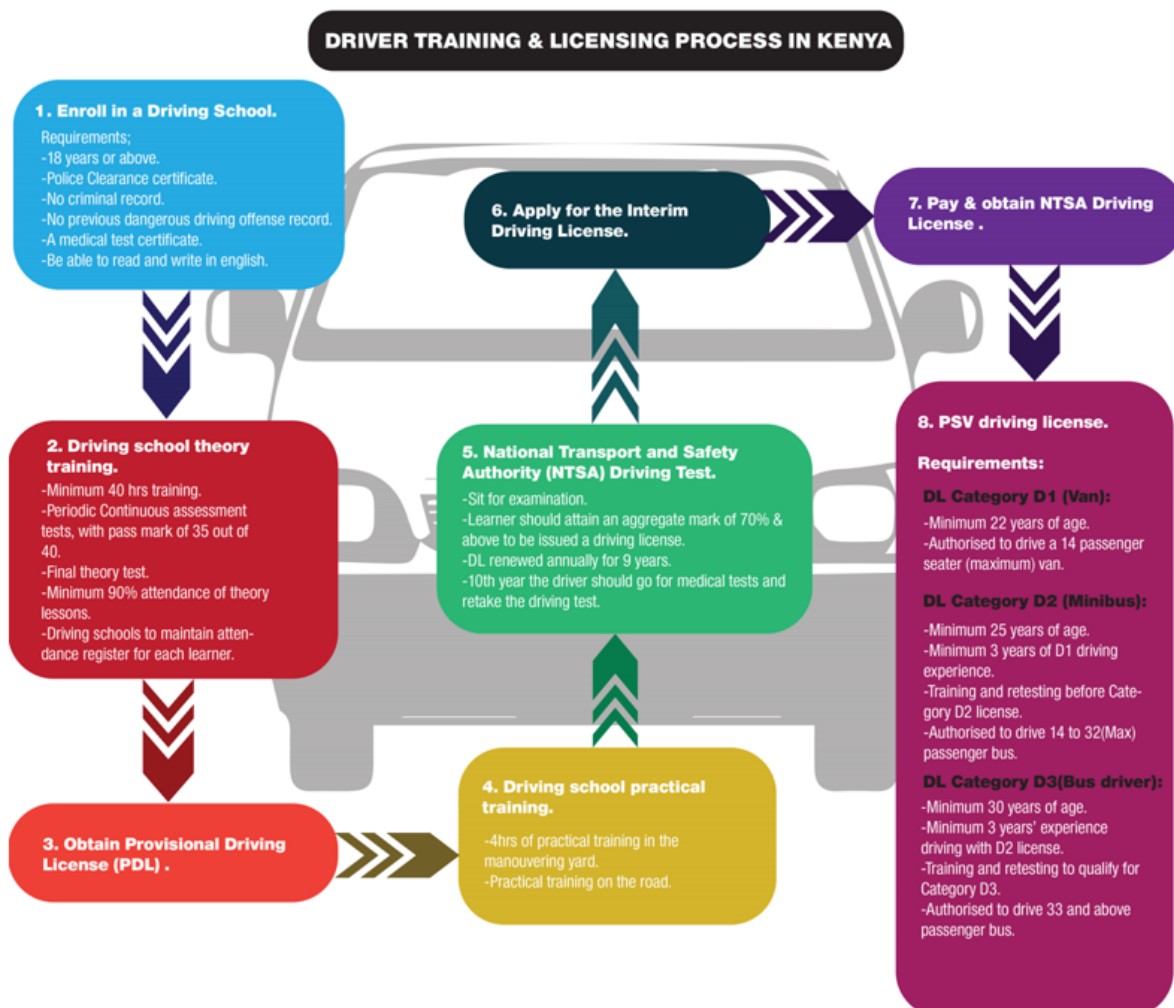
FIGURE 3 Driver training and licensing process in Kenya.

2.6   E-learning

With the advent of Information and Communication Technology (ICT), E-learning has been recognized by public officers as a critical tool for skill development in government institutions (Nisar, 2004). Through e-learning, organisations can utilize technology effectively to uplift staff skills for improved performance and efficiency (Nisar,2004). Cidral, Oliveira, Di Felice, & Aparicio (2018) define E-learning as "a web-based learning ecosystem for the dissemination of information, communication, and knowledge for education and training." On the other hand, (Tarus, Gichoya, & Muumbo, 2015) describe E-learning as "a method of training supported by Information Communications and Technology (ICT)." Garrison (2011) states that E-learning is "electronically mediated asynchronous and synchronous communication to construct and confirm knowledge."

Online learning uses now readily available Information and Communication Technology (ICT). Many governments prefer online training as it is cheaper, more flexible, and can reach more employees at different locations and their preferred times (Cidral et al., 2018, Tzy-Ling Chen,2014). Furthermore, Virtual Learning Environments (VLEs) can facilitate collaboration between institutions in content development and training methods (Gunga & Ricketts, 2008). E-learning reduces training costs as premises, travel, subsistence allowances, and travel time are eliminated. Staff do not leave work to attend training (Nisar, 2004). The writer adds that e-learning provides consistent training, which is more flexible and personalized learning. Individuals can pace their learning based on their available time, which can be accessed at different locations (Nisar,2004). According to Becker, Fleming, and Keijsers (2012), organisations can develop skills, boost organizational performance, and increase staff morale through E-learning.

Mobile technology enables people to move around with their own devices enabled by high computing ability, including cell phones, e-book readers, laptops, and personal digital assistants (PDAs). The combination of increased computing capabilities, wireless technology, and portability makes mobile devices practical learning tools for classroom setup and informal learning (Sung, Chang & Liu, 2016).

Despite the advantages, there are some challenges related to e-learning. While young people are tech-savvy and would readily embrace the e-learning approach, there is often fear that e-learning may present difficulties to older learners with limited computer and mobile technology skills (Becker et al., 2012). Secondly, compared to traditional face-to-face instructor-led training, which is seen as personal, people-friendly, and warm, e-learning can be viewed as less friendly, lonely, and indifferent. Nisar (2004) adds that face-to-face training allows staff to mix, socialize, and network in a relaxed atmosphere, which is not the case with online training. Further, Nisar (2004) adds that e-learning is relatively more expensive initially. According to Penporn and Jeremy (2006), e-learning training materials are costly, thus the need for economies of scale which often comes with the tendency for "one-size fits all" pedagogy. There is usually a risk of adapting foreign e-learning approaches for local content, overlooking essential aspects such as the local learning style and culture.

2.7   Micro-learning

Mobile –learning (M-learning) has been described as a mode of instruction delivered through mobile devices enabled by wireless networks or Local Area Networks (LANs). Learners can access study materials through mobile smartphones or tablets (Wen and Zhang, 2015). Kukulska-Hulme & Traxler (2005) describes M-learning as "a personal, unobtrusive, spontaneous, 'anytime, anywhere' way to learn and to access

educational tools and material that enlarges access to education for all." They add that M-learning enhances the sense of ownership of the learning experience and avails without any limitation on the time and location for learning. Ally (2009) argues that M-Learning is accessible to residents living in remote areas with few or no trainers and inadequate physical facilities for learning. If appropriately tailored to suit the needs of users with disabilities, M-leaning can be an effective tool in creating inclusive M-learning opportunities (Kukulska-Hulme & Traxler, 2005).

Nilsson (2021) states, "Micro-learning is a concept of small units of focused and condensed learning activities that can be performed on various devices." Nilsson (2021) views micro-learning as an effective tool for enhancing long-term memory. Mobile-based micro-learning is delivered in small chunks of learning activities through mobile phone technology (Nikou and Economides, 2018). Micro-learning applications break-down training content into small portions which are simplified and easier to understand. The compact format or m-learning content makes it easier and more convenient to access through mobile applications. There are many such applications, for example, MobieTrain, Edapp, Qstream, GoSkills, 7taps, and Learnie, among others (Bariuad, 2022).

A study by MobieTrain (2022) of 300 Companies across Europe identified the following as the key challenges the companies faced in training and development;

- Poor retention of learning content;
- Lack of measurement of learning impact;
- Most training does not match employee needs;
- Training is expensive, and developing training content is time-consuming.

To overcome the above challenges, companies are moving towards various training strategies with more online training (MobieTrain, 2023). Mobile technology enables people to move around with their own devices enabled by high computing ability, including cell phones, e-book readers, laptops, and personal digital assistants (PDAs). The combination of increased computing capabilities, wireless technology, and portability makes mobile devices practical learning tools for classroom setup and informal learning (Sung, Chang & Liu, 2016).

Wijsman et al. (2015) indicated that student motivation to learn is associated with student performance. Educational institutions globally seek ways to enhance the reason for improved student performance (Nikou and Economides, 2018). Online training methods have remained relatively unchanged over time, thus failing to match the demands of adult students with limited learning opportunities, often preferring mobile technology (Carter & Morgan, 2022). Whereas traditional online courses try to replicate face-to-face training, micro-learning breaks down the course materials into small learning portions delivered over time. Mobile technology makes micro-learning a more flexible and cost-effective learning method allowing learners time to reflect on previous materials before proceeding to the next lesson. Mobile technology enhances personalised learning, and learners can continue learning whenever they have a free moment, irrespective of their location (Carter & Morgan, 2022). Wen and Zhang (2015) state, "Learners can get the information they need, at any time, anywhere, using fragments of time in their busy schedules and achieving a real sense of autonomous learning."

However, Kukulska-Hulme & Traxler (2005) acknowledges that users may face some challenges with m-learning. With the small size of mobile phone screens, minute texts and figures, small keyboards, and buttons, users may strain their eyes as they read the training content. In addition, reading screen content in

bright sunlight may be difficult. Inadequate charging facilities and poor internet access may also present challenges to learners. Noise in public transport vehicles may interfere with learning, especially for phones without hands-free and audible speakers. Other challenges include difficulties in data transfer and language barriers (Kukulska-Hulme & Traxler, 2005)

2.8   Designing a practical online course

Different online courses use different designs, delivery, and evaluation methods. Chin and Williams (2006) argue that the main objectives of an educator are to create a memorable learning experience and achieve the expected learning outcomes. There is a need to develop an "integrated and all-encompassing learning environment" (Chin & Williams, 2006). Various methods for content-sharing and transmission should be integrated into the course, such as video recordings, PowerPoint presentation slides, and links to additional resources. Tools such as email, chat rooms, and online meetings facilitate communication in online training (Crawford-Ferre & Wiest, 2012). Language can create a barrier to online training as learners sometimes fail to understand the course content; thus should be addressed adequately. Cultural inhibitions may also hinder learning and should be considered during online course design (Crawford–Ferre & Wiest, 2012). Harasim (1990) emphasized the importance of peer interaction among students to enhance deep understanding of the subject; peer interaction creates ownership of new knowledge, interpretation, and communication and sharing with colleagues based on experience and gaining new perceptions from peers.

The internet is a rich source of information, and hyperlinking helps to interlink topics, ideas, and information from many sources. Brown (1997) argues that the internet can be used to create interconnected sources of knowledge, facilitating the student to explore across "theory, application, models and paradigms" in the subject area and to also interconnect with other courses. Inter-disciplinary connections can be created through hyperlinking to tap knowledge from other disciplines. For example, a Transportation student can access materials in Behavioural science or obtain related information and expertise in Economics (Brown, 1997).

Trainers of online courses often rely on Learning Management Systems(LMS) or Course Management systems (CMS) for teaching distant learners, which influences the way online training is delivered and how it is perceived by students (Baldwin & Ching, 2019). The LMS affects "pedagogy by presenting default formats designed to guide the instructor towards creating a course in a certain way" (Lane, 2009). Some examples of LMS include Canvas, Blackboard, Desire2Learn (Brightspace), and Moodle (Baldwin and Ching, 2019).

Evaluating online courses is critical to ensuring they meet the required quality standards. Various evaluation tools are available for course designers and trainers of e-learning, for example, Quality Matters and OSCQR (Baldwin and Ching, 2019).

2.9   Identified gaps

The critical gap identified in this study is the general lack of post-license training for drivers. Both the drivers and the SACCO officials who participated in the study confirmed that the drivers do not receive any training after obtaining the driving license from NTSA. Though SACCO operators understand the importance of continuous training, they do not have a driver training policy. Some operators, such as Kaka

Travellers and Kenya Bus Service Management, indicated that they used to train drivers before COVID-19. However, due to the pandemic's adverse effects, they lack resources to fund such training.

A second gap identified is the lack of government policy and an appropriate curriculum for continuously training public transport drivers. The training should include road safety, basic mechanics, customer service, and emergency response.

A third gap is the lack of a curriculum for Bus Rapid Transport (BRT) drivers training. This should accompany the introduction of a BRT driver's license for drivers who have taken the BRT training.

3   Public Transport in Nairobi

3.1   Modal share

The capital city, Nairobi, accounts for about half of formal employment in Kenya and a similar proportion of the Country's Gross Domestic Product (GDP). However, the City faces growing mobility challenges. Forty percent of the trips in Nairobi are by foot, while forty-one percent are by public transport, while only thirteen percent are by car (JICA, 2014). However, the city lacks reliable, efficient, and organized public transport to support accessibility to jobs and services. According to a household study done in 2013 in fifteen Kenyan urban areas, 89 percent of urban residents either walk or use paratransit transport for their daily trips (Salon and Gulyani, 2019).
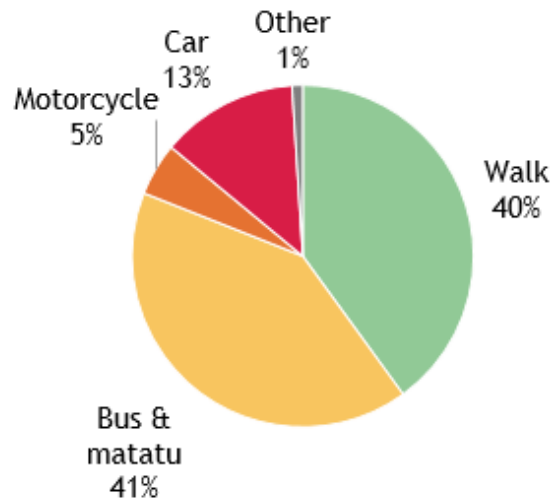
FIGURE 4 Modal share in Nairobi (JICA, 2014)

3.2   Public Transport in Nairobi

Public transport in urban areas in Kenya is dominated by an informal privately-operated transport system (Nderitu, 2017, Klopp, Harber, & Quarshie, 2019). The public transport vehicles called "matatus' include 14-seater vans and 25, 33, 36, 52, 56, and 60-seater buses. When the matatus are not operating, the City of Nairobi is near a standstill (Mutongi, 2017). Owners of the vehicles have organized themselves into Corporative movement (SACCOS), which assists in industry self-regulation (Nderitu,2017). A SACCO should have a minimum of 30 Public Service Vehicles (PSVs) to be registered by NTSA (Mwanza, 2023). However, while only 272 Matatu SACCOS are registered to operate in Nairobi, according to the NTSA, the Nairobi City County Government (NCCG) presents different statistics of 692 Matatu SACCOs working in the City. This implies that more than half of the SACCOs operating in Nairobi are not registered with NTSA.

The Matatu industry has experienced rapid growth over the recent years. According to Matatu Owners Association (MOA), 2009, the estimated number of matatus in the country is 40,000, of which 11,000 ply in Nairobi. The sector supports approximately 160,000 jobs, half direct and the remaining half indirect. Compliance with traffic laws is poor, resulting in traffic crashes. Unlike formal bus systems, which are fully regulated with fixed schedules, stops, and fares, the informal public transport system, known as "paratransit, "is not scheduled and is characterized by flexible routes, fares, and stops (Klopp et al., 2019).) The matatu system pays route licenses and other fees to NTSA and County Governments and should not be considered informal (Kloppe et al., 2019).

Through the Digital Matatus project, a collaboration between Kenyan and American Universities and the ICT sector in Nairobi developed a map of the Matatu routes in Nairobi, shown in Figure 5 below.

FIGURE 5 Nairobi Matatu routes (Source: moovitapp.com)

3.3   Nairobi Metropolitan Transport Authority (NaMATA)

To address the transportation challenges in Nairobi, the Government of Kenya established Nairobi Metropolitan Area Transport Authority (NAMATA) in 2017 to oversee the planning, implementation, and operations of an integrated, efficient, reliable, safe, and sustainable transport system in the Nairobi Metropolitan area (NMA). NaMATA is a state corporation under the Ministry of Roads and Transport (MORT) and is charged with the following functions;

- To develop, formulate, and implement public transport strategies, plans, and policies;
- To coordinate developing, managing, and maintaining mass rapid transit systems (MRTS) with other government agencies and parties;
- To regulate and enter into agreements with transit operators and service providers;
- To facilitate integrated transport and land use planning;

- To improve the environmental sustainability of the transport system in the Metropolitan Area.

3.4 BRT Masterplan for Nairobi

The Mass Rapid Transit System (MRTS) Harmonization Study (2014) identified five BRT corridors for implementation in Nairobi alongside commuter rail rehabilitation and extension to enhance the public transport system (Gauff Consultants, 2014), as shown in Figure 6 below.
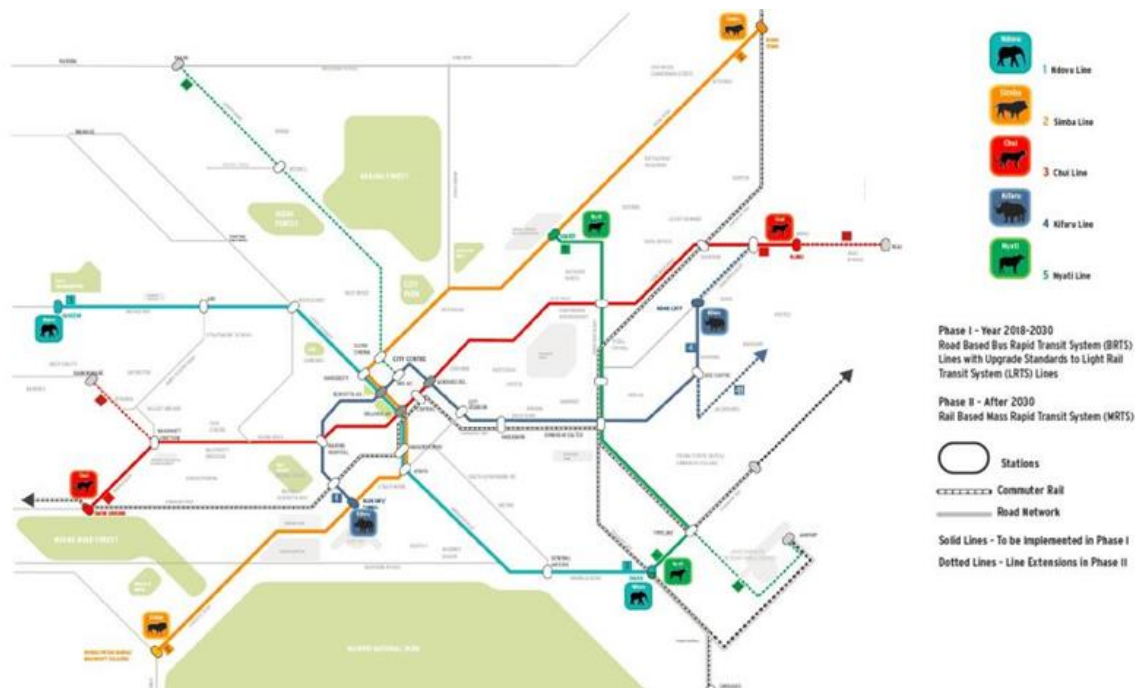
FIGURE 6 MRTS Masterplan for Nairobi (Gauff Consultants, 2014).

The Nairobi Metropolitan Area Transport Authority (NaMATA) has commenced implementing a pilot BRT project along Thika Superhighway from Ruiru town to Kenyatta National Hospital (KNH) through the Central Business District (CBD). The project scope includes the construction of 20 km of dedicated BRT lanes and thirteen intermediate median BRT stations, alongside modifying the existing ten foot-bridges to provide access to the median stations. In addition, the project includes the construction of a BRT terminal at KNH, depots at Ruiru and Kasarani stadium, a transfer station at Nairobi Railway Station, and Non-Motorised Transport (NMT) facilities along the corridor.

Three other BRT lines, BRT Line 1, Clean BRT Core Line 3, and BRT Line 5, are undergoing detailed planning and design. A public transport transition process is underway, and the operators have established a Bus Operating Company (BOC) designated to run the BRT Line 2 services.

4   Research Methodology

4.1   Introduction

This Chapter discusses the research methods that the researcher employed in the study. The Chapter covers the research design, the study target population, the sampling method, data collection tools and procedures, data analysis and presentation, and the research ethics.

4.2   Research design

A research design involves multiple intertwined decisions relating to the research approach and provides a suitable framework for the study (Sileyew, 2019). Research design is necessary for a research process as it provokes decision-making on appropriate methods for data collection, data analysis, and how to use the data in the study. In the research design, the researcher presents the process and decisions, justifying the choice of specific methods over others. A persuasive research design must demonstrate to the reader that the researcher can plan the research project and has seriously reviewed existing literature in the area of focus (Schwartz-Shea, Peregrine & Yanow, Dvora,2012).

4.3   Target population

The target population for this study includes matatu drivers in the Nairobi Metropolitan Area. According to Matatu Owners Association (MOA) (2009), the estimated number of matatus in the Nairobi Metropolitan area is approximately 11,000. The number of drivers is estimated as one and a half times the number of matatus which is 16,500.

4.4   Sampling technique and sample size

Due to limitations in funding, time, and convenience, researchers are often unable to test every single person or unit in a population, thus necessitating the selection of a small group to represent the larger population, referred to as a sample (Sharma, 2017). "Sampling is a technique (procedure or device) employed by a researcher to systematically select a relatively smaller number of representative items or individuals (a subset) from a pre-defined population to serve as subjects (data source) for observation or experimentation as per objectives of his/her study." (Sharma, 2017).

Two sampling methods were used in this study. Purposive sampling was used to select the SACCOs officials to participate in the study. Purposive sampling, also called selective, subjective, or judgemental sampling, is a non-probability sampling technique that depends on the researcher's judgment in selecting the sample (Sharma, 2017). This sampling method may have limitations due to potential subjectivity in the choice of the sample (Etikan, Musa, & Alkassi, 2015). The researcher found the method appropriate due to difficulties in developing a random sample from the large population of matatu SACCOs in the Nairobi Metropolitan

area. The second reason why this method of sampling was preferred was due to limited resources and time to undertake the research.

Simple random sampling was used to identify the drivers in the SACCOs. This method is considered fair and has the advantage of being simple and easy to implement. Nine companies/SACCOs from matatu routes spread throughout the Nairobi Metropolitan area (NMA) were identified to ensure a representative sample. Each of the officials from nine SACCOs was given five questionnaires in hard copies to forward to five drivers in their SACCO to fill and return. They were further requested to include lady drivers to ensure gender parity.

4.5   Data collection tools

A high-quality data collection plan should answer the questions of who will be involved, what they will do, where, when, and how they will do it (Paradis, O'Brien, Nimmon, Bandiera, & Martimianakis, 2016). Data collection methods for qualitative data include; Open-ended questions included in surveys, and interviews, on the other hand, are suitable for one-to-one data collection using a list of pre-determined questions, focus groups, and observations (Paradis E. et al., 2016).

The researcher developed two tools: an interview schedule targeting the SACCO/Company official/director and a questionnaire for the bus/matatu drivers.

4.5.1   Interview schedule for SACCO officials

The data collection tool for the SACCO/Company officials was an interview schedule with open-ended questions to guide the discussion. A copy is attached in Appendices 2.

4.5.2   Questionnaire for PSV drivers

The questionnaire for drivers was semi-structured. The researcher ensured the questions were easy to understand and provided multiple choices. The researcher then printed the questionnaires as it was easier and faster for the respondents to respond as drivers spent most of the day in their vehicles. Each of the nine paratransit Companies/SACCO was requested to select five drivers to respond to the questionnaire. A copy of the driver questionnaires is attached in Appendices 3.

4.5.3   Pre-test

A pre-test is a process carried out in actual study conditions to critically examine the understanding by the respondents of each of the questions in the questionnaire. The researcher pre-tested the questionnaires by requesting two drivers from one of the SACCOs to complete the questionnaires before the survey. Based on the pre-test, the researcher improved some questions to enhance clarity.

4.6   Data collection process

4.6.1   Primary data

Primary data was collected from two categories of respondents; the first group was paratransit SACCO/Company officials, and the second was matatu drivers for SACCOs operating in the Nairobi Metropolitan Area.

For the SACCO/Company officials, the researcher held open face-to-face interviews with each respondent and, guided by the interview schedule, obtained in-depth information about their SACCOs/Companies

operations, comments, and suggestions to enrich the E-learning course. The researcher initially expected to interview ten officials but, due to time constraints, was only able to interview nine, thus a response rate of 90 percent. Each session with the SACCO official took approximately forty-five minutes. A few officials preferred restaurant meetings, while others chose to meet in their offices. The interview with the Kanya Bus official was held virtually.

The second category of respondents included 39 drivers picked randomly from paratransit SACCOs Companies in Nairobi Metropolitan Area. The questionnaires were administered to the drivers through their Company officials. After each interview with the SACCO official, the researcher would give the official five printed questionnaires for drivers. In each case, the Official was requested to identify about five drivers to fill out the driver questionnaires and include female drivers. After about two weeks, the researcher collected the completed driver questionnaires from the SACCO officials. The data collection was conducted in March 2023.

4.6.2 Secondary data

The secondary data collection involved reviewing existing literature on key research areas, including road safety in Kenya, learning theories, driver training e-learning, micro-learning, and how to design effective online courses. The literature review helped to gain a deeper understanding of the subject and to inform the design of a user-friendly course. The writer searched for relevant scientific materials through Hasselt University Library, Google Scholar, Journals in the education and road safety fields, the World Bank library, and cited articles. Additional secondary data was obtained from the Kenya government policies, regulations, and NTSA driver training curriculum, among others.

4.7 Research ethics

"Research ethics is the appropriateness of the researcher's behavior in relation to the rights of those who become the subject of the research project, or who are affected by it" (Saunders, Lewis, & Thornhill, 2009).

The researcher ensured that the research process was open, considerate, and impartial. The researcher confirmed that the rights of the study participants were observed throughout the study by;

- Explaining to them the objectives of the study;
- Protecting the information shared by respondents;
- Protecting the identity of the respondents from third parties;

Before the interview with each SACCO official, the researcher shared a copy of an approval letter from NaMATA introducing the researcher and explaining the study's objectives. The researcher only collected and processed the personal data necessary for the study.

During the data collection stage, the respondents were adequately briefed about the study and the plan to develop an E-learning course for PSV drivers in Nairobi Metropolitan Area. The researcher also explained that the data collected would only be used for academic purposes and not shared with third parties. In addition, the researcher also appropriately cited sources of information used in the study.

5 Data Analysis and Findings

5.1 Data processing

Nine SACCO/Company officials/directors were interviewed. Each SACCO official was requested to identify five drivers from their SACCO for the driver questionnaire. However, forty Matatu/Bus drivers responded to the driver questionnaires out of the expected 45. Unfortunately, the questionnaire by the only female driver who responded was incomplete and was therefore removed, leaving 39 respondents. Hence the response rate was 87 percent.

The data collected through hard copy questionnaires were entered into the computer and cleaned in readiness for analysis.

5.2 Data analysis

Qualitative data from SACCO officials were categorized into key themes and concepts from which discussions were drawn. Coding and categorizing were used for analyzing qualitative data. There were only nine respondents; the researcher did not need to use software to analyse the responses from the SACCO officials.

The researcher used SPSS Software for quantitative data analysis of the driver responses. SSPS was chosen for analyzing the qualitative data from drivers as it is easy to use and produces easy-to-interpret bar charts and pie charts. After the qualitative and quantitative data analysis, the interpretation was made through descriptive narration, including secondary data information.

5.3 Responses from SACCO/Company officials

Gender: The researcher included a question on gender to assess the gender balance of the respondents and check whether the responses varied with gender. Out of the nine respondents, only one was female. The following is a summary of their responses;

Name of SACCO/Company: This question was included to establish the SACCOs/Companys and the routes that they operate within the Nairobi Metropolitan area. The researcher sought to balance the geographical spread of the routes throughout the city.

Position in the SACCO/Company: The respondent's role in the Company /SACCO was essential to confirm that they could authoritatively respond to questions on SACCO/Company policy on driver training. The nine SACCO Officials interviewed were SACCO/Company Chairmen, directors, or Operations Managers, which confirmed that they could confidently respond to policy issues.

Route/s that the SACCO plies: The researcher was keen to ensure that the routes covered were geographically spread throughout the study area. The SACCOs/companies ply multiple routes in the city, thus covering the entire city.

Vehicle sizes: The researcher included this question to establish whether the SACCO/Company operates small, medium, or large buses. Higher-capacity bus drivers may find it easier to drive a BRT. The SACCOs operate varied vehicle sizes, from 14-seater, 33-seater, 36-seater vans to 60-seater buses.

The number of drivers and gender: The SACCOs/Companies with the largest fleet are City Hopper, with 250 drivers, and Kenya Bus, with approximately 210 drivers.

Most SACCOs/Companies do not employ female drivers, and the ones that do, such as Kenya Bus Service Management (KBSM), female drivers are very few. The explanation was that the working environment, late and early working hours were not friendly to female drivers.

Minimum qualifications for drivers: Half of the officials reported that their minimum entry requirement is a Form Four Certificate and Class D1 driving license. The other half base their driver entry on a Class D1 license and Certificate of Good Conduct issued by the Police and a minimum of four years of driving experience. This question aimed to establish the level of education so that the researcher would tailor training to suit the drivers' level of education and driving experience.

On-job training for drivers: This question aimed to establish whether the SACCO/Company have a policy for continuous training of their drivers.

Most SACCOs reported that they do not provide any on-job training for drivers and therefore rely entirely on driving school training. However, MCA SACCO stated that their drivers attend NTSA training once a year; Kaka Travellers responded that the SACCO used to conduct internal driver training before COVID-19, but they no longer do it due to a shortage of funding- the public transport sector has not fully recovered from the adverse impact of the pandemic. Latema SACCO drivers train their drivers on education day. None of the SACCOs have tried online training for their drivers. None of the SACCOs has a driver training policy, indicating a gap in training.

Wi-Fi in Matatus/buses: Drivers will require a strong internet network to access the E-learning course. The researcher intended to establish the ease of access to the internet for drivers. Seven of nine SACCOs/Companies do not provide Wi-Fi in their vehicles. The two SACCOs who provide Wi-fi do so to play music to attract passengers.

The training needs for public transport drivers: Through this question, the researcher sought to establish areas that may require more focus in designing an E-learning Course for drivers from the perspective of the SACCO/company official.

According to the SACCO officials, the public transport drivers' training needs include; Road Safety/Defensive driving, awareness of other road users, care for passengers as they board or alight from public transport vehicles, driving human cargo, speed control, customer service/public relations, driving BRT buses, traffic rules and regulations, driver rights, driver health issues, emergency procedures and first aid and basic mechanics. The officials indicated that a lack of awareness of other road users is often a fundamental cause of road crashes, especially involving cyclists.

Whether drivers have adequate time to study; Majority of the SACCO officials were confident that their drivers have sufficient time to take the training. The researcher learned that the big buses (above 46 seaters) wait 30 to 40 minutes at the bus station, and drivers can use the time for training. Smaller buses have a shorter waiting period of about 15 minutes. Drivers can also train during off-peak hours, with one SACCO

official estimating that drivers can spare up to 2 hours per day for training. Two SACCOs are willing to make special arrangements, such as day offs for training.

On foreseeable challenges: The researcher wanted to pre-empt any potential challenges that may hinder the implementation of the online course and make appropriate recommendations to the SACCO/Company officials and the government. According to the SACCO officials, the only foreseeable challenge with the implementation of E-Learning is internet access, as most SACCOs do not provide free Wi-fi in the vehicles.

What would motivate the drivers to take the training, complete it, and practice what they learn? The SACCO official suggested as follows;

- Drivers should be issued a Certificate upon completion of the course, which the drivers can present during the recruitment of BRT drivers;
- The Courses should have alerts to remind the drivers to take the course:
- A combination of close performance monitoring, a reward system for best performers, improved employment terms, and some level of enforcement will motivate drivers to practice what they learn. "Best Driver Award" should be introduced based on safe driving, discipline, and good customer service.

Other suggestions;

- One respondent noted that public transport drivers have no special driver training.
- Suitable training for bus conductors should also be developed as conductors constantly interact with customers. The respondent added that conductors are involved in a majority of reckless passenger injuries. There is a need to improve the way conductors communicate with passengers.
- There is a need for permanent employment by the Matatu SACCOs or Companies.
- It is necessary to monitor behavior change after training.
- KBSM is keen on this training as it will make the industry more professional and efficient. The Company is willing to support the training program.
- A director from one of the Companies indicated that; "this training is excellent, and as many of the public transport drivers as possible should go through the training."
- The online training should be easy to follow-simple with a mix of English and Kiswahili.
- One of the officials suggested that training should be done in a Workshop set-up.
- Online driver training is a good idea since BRT is expected soon.

5.4   Responses from public transport drivers

Thirty-nine drivers, out of the expected forty-five, responded to the driver questionnaires. The following charts generated using SSPS Software capture their responses.

1. Driver gender

This question aimed to assess the gender balance of the respondents and to check whether the responses varied with gender. Despite the researcher's request that female drivers be included in the survey, all the respondents were male.

2. Age of the driver?

This question aimed to establish the age distribution of the drivers; as observed by Becker, Fleming, and Keijsers (2012), there is often fear that e-learning may present difficulties to older learners with limited skills in the use of computers and mobile technology. In addition, older learners may experience challenges with the small size of mobile phone screens, minute texts and figures, small keyboards, and buttons, and users may strain their eyes as they read through the training content use of mobile phones (Kukulska-Hulme and Traxler, 2005).
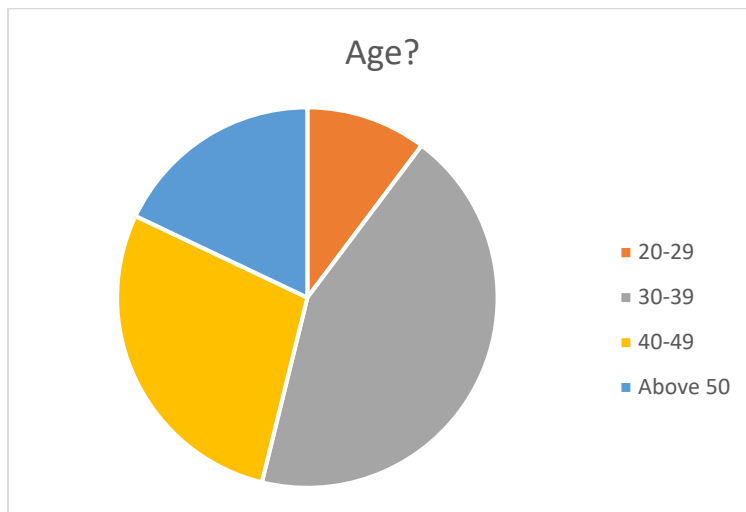
FIGURE 7 Pie chart on driver age brackets.

Most public transport drivers who responded to the questionnaire are 30 to 49 years followed by 40 to 49 years. The drivers are relatively young and unlikely to experience mobile technology challenges in online training.

Q3. Level of education

This question aimed to establish the drivers' level of education so that the training could be designed to suit the drivers' level of education.
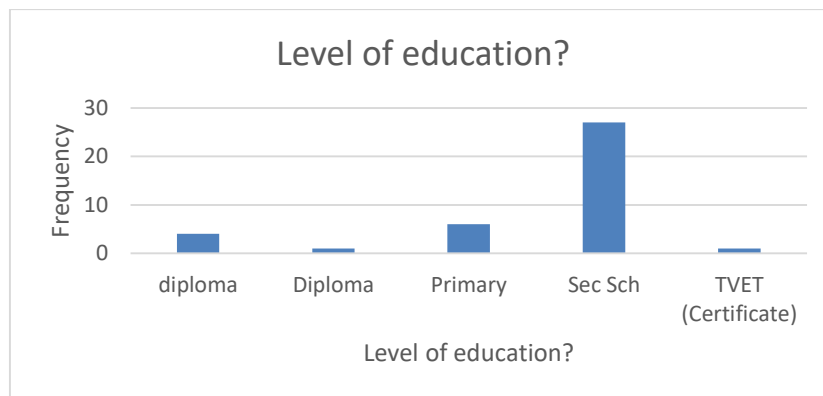
FIGURE 8 Level of education for public transport drivers.

About 85 percent of the drivers have a High School Certificate or above, confirming the response from the SACCO officials that the minimum entry requirement for drivers is Form Four Certificate for most SACCOs. The online training targets Form Four Certificate holders.

Q4. Driving License Category

The researcher included this question to assess compliance with the government requirement that a public transport driver should have driven for four years and hold a minimum Class D1 to operate a public transport vehicle.
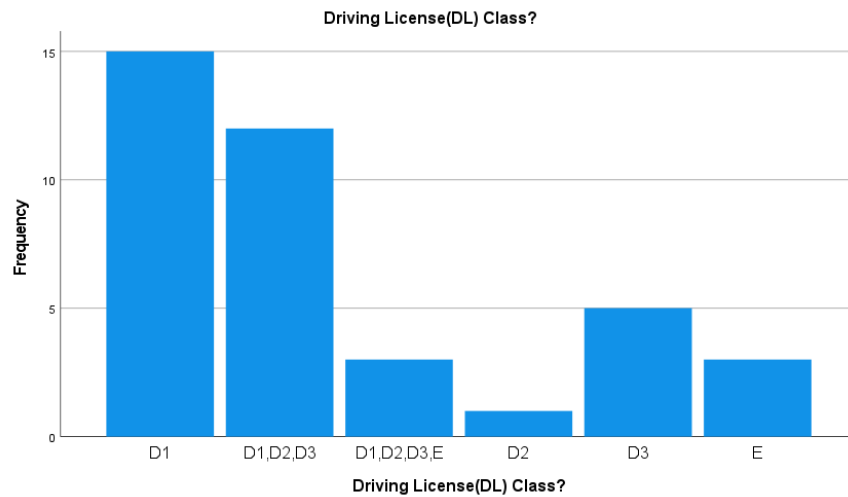
FIGURE 9 Driving License category.

Most public transport drivers hold the Class D1 license and are authorised to drive only 14 seater matatus. Many drivers have Class D1, D2, and D3. They can drive public transport vehicles, from 14-seater vans to 60-seater buses, implying that most drivers have the license for higher-capacity buses and can train to be future BRT drivers.

Q5. How long has the driver driven PSV/Matatu?
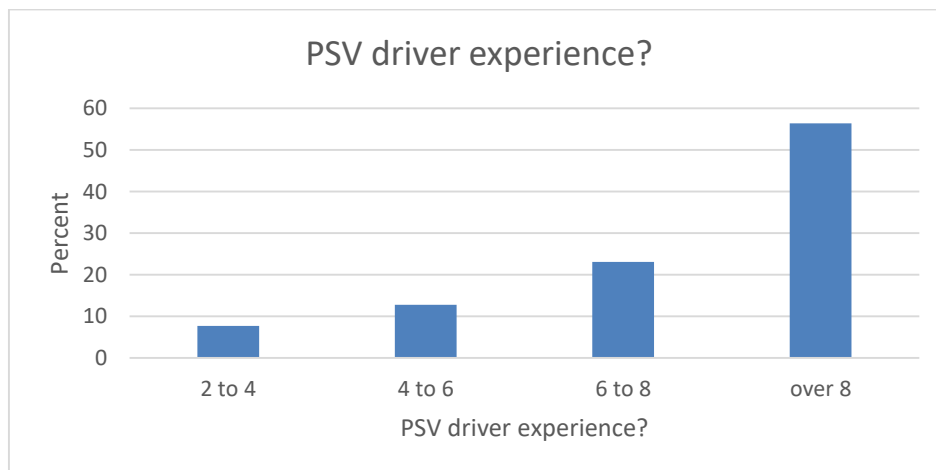
FIGURE 10 Driver experience with public service vehicles.

About 80 percent of the respondents have more than six years of experience as public transport vehicle drivers. The drivers have substantial experience in public transport vehicle driving; thus, the online design will be tailored to drivers with a medium driver experience level.

Q6. Which SACCO/Company does the driver work for?

The researcher included the above question to establish the name of the SACCO/Company and the routes they operate within the Nairobi Metropolitan area to ensure comprehensive coverage of the study area.
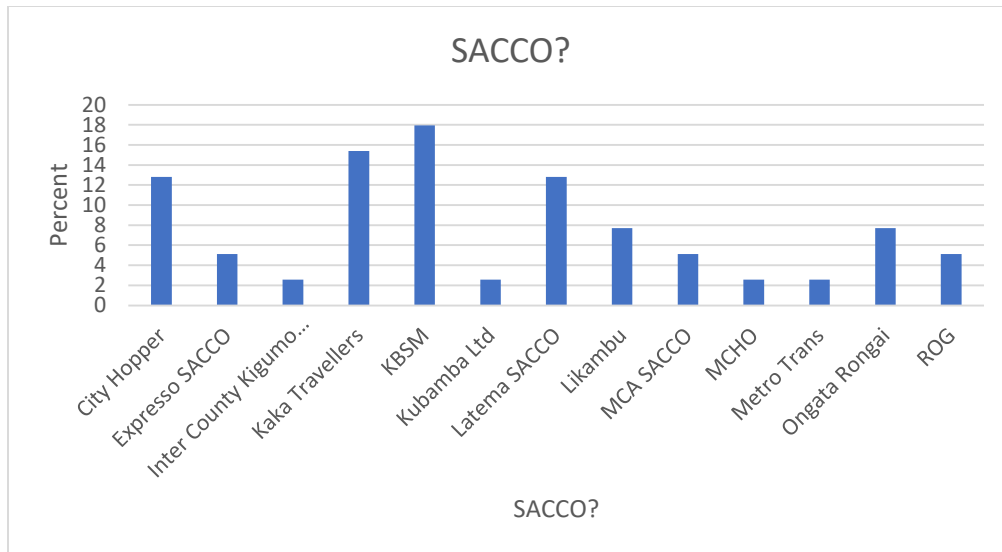
FIGURE 11 The SACCO/Company the driver is currently working for.

Thirteen SACCOs/companies participated in the surveys with a wide geographic coverage of routes. Most respondents were from the more prominent operators, including Kenya Bus Service Management (KBSM), City Hopper, and Latema SACCO, implying that the larger SACCOs/Companies employ more drivers.

Q7. The route most frequently plied by a driver?
The researcher was keen to ensure that the routes covered were geographically spread throughout the study area. Most drivers responded that they ply multiple routes in the Metropolitan area.

Q8. What is the size of the vehicle the driver has been driving?

This question was meant to establish the capacity of the bus/matatu each driver drives. High-capacity bus drivers may find driving high-capacity BRT buses easier.
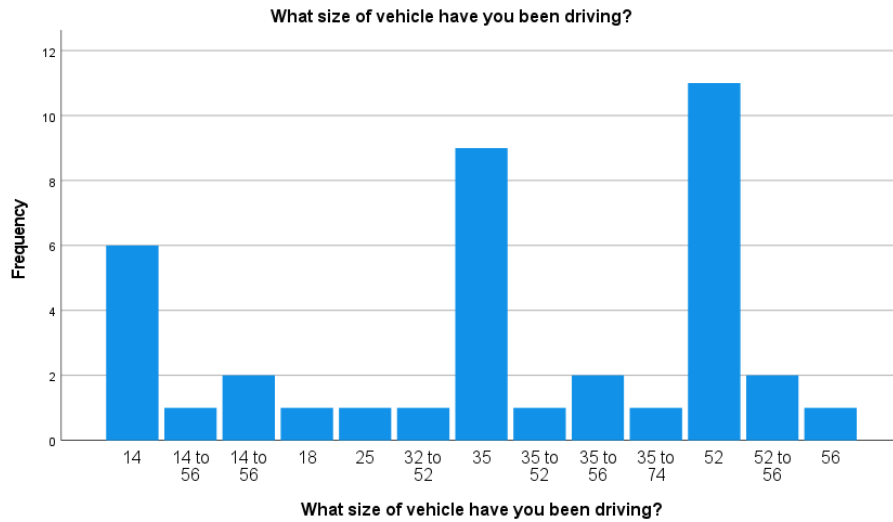
FIGURE 12 The size of the vehicle the driver has been driving.

Most respondents drive fifty-two seater buses followed by thirty-five seater and fourteen seater buses, indicating that most current matatu drivers can transition to BRT training with some BRT training.

Q10. Whether the driver would be interested to learn about BRT?
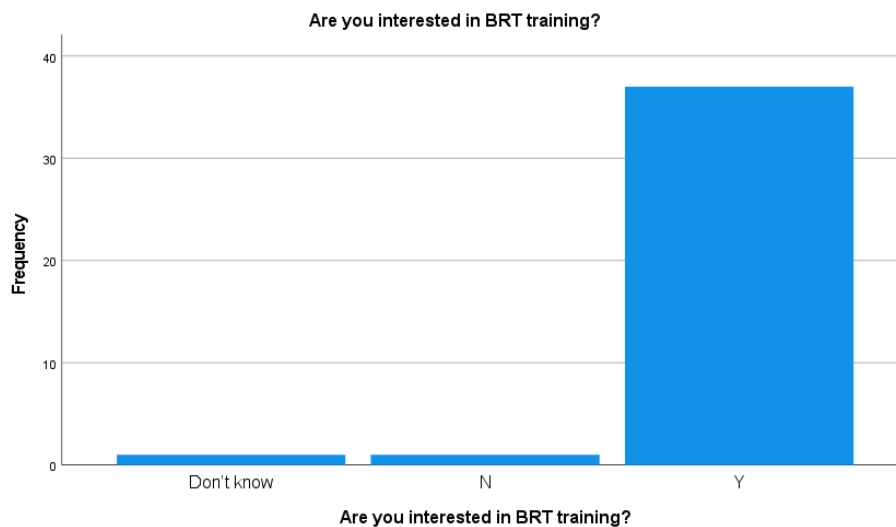
FIGURE 13 Are you interested in learning about BRT?

Over 90 percent of the drivers are keen to learn about BRT. Based on this response, the researcher included a BRT Module in the PSV driver training.

Q11.Whether the driver had taken any online training previously. Q12.Whether the driver completed the training. Q13. If they did not complete it, why not.

Studies have established that most students who register for Massive Open Online Courses (MOOCs) fail to complete their courses, and worse, many of them terminate their learning quite early in training (Sammour et al., 2015). Questions 11,12, and 13 aimed to assess whether the drivers have any previous experience with online training and to know their experience.
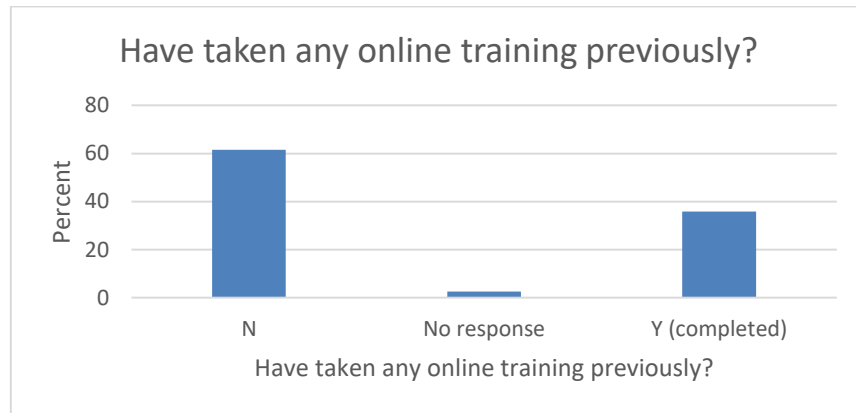
FIGURE 14 Previous online training,

About 65 percent of the drivers have no experience in online training. About 35 percent reported having done and completed the online training. The E-learning course design assumed minimal exposure to online training. The researcher recommends initial training on signing in and accessing the training.

Q14. How the driver accesses the internet?

The aim of Question 14 was to establish how the drivers access the internet, as the drivers will require a strong internet connection for the online training.
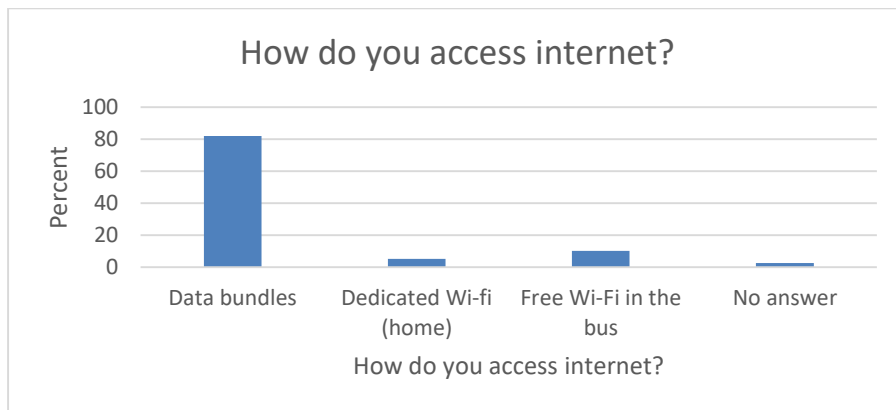
FIGURE 15 Access to the Internet.

Q15.Is the driver satisfied with the internet quality at the moment?

This question aimed to assess the quality of internet access, as a strong internet connection will be required for the online training.
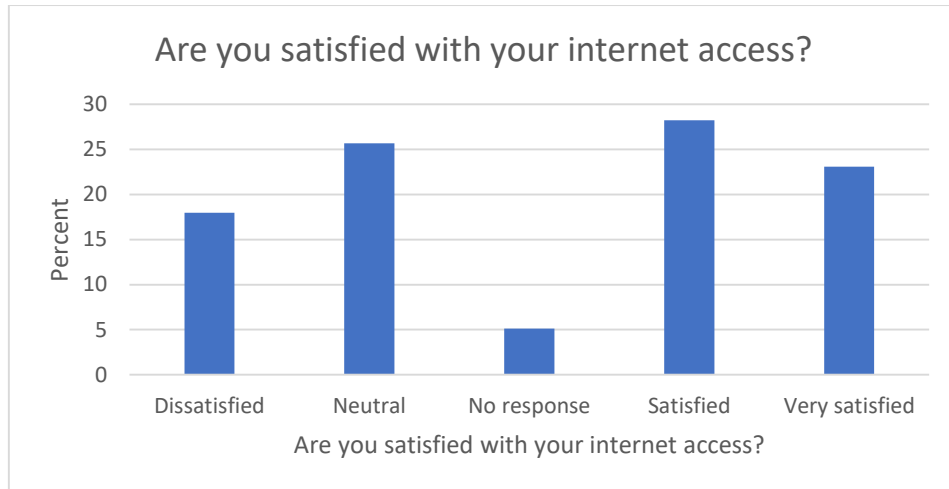
FIGURE 16 Quality of Internet access.

About eighty percent of the respondents access the Internet by buying data bundles from local Internet providers. Though most drivers have reasonable internet access, the training Module is quite heavy and may not be supported adequately by the Internet through data bundles. The researcher has recommended that public transport operators provide internet in their vehicles. The researcher has also recommended that the Counties provide internet at the matatu stages in their counties.

Q16. What type of phone the driver has currently?

To undertake an online course, the learner will require a smartphone. The researcher wanted to establish whether the drivers have smartphones.
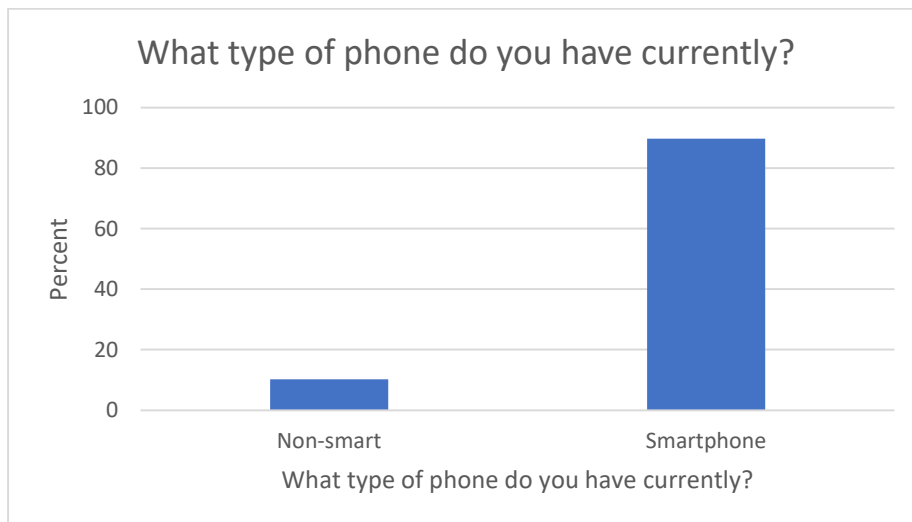
FIGURE 17 Type of phone.

Approximately 90 percent of PSV drivers have smartphones, which is positive feedback as online training requires a smartphone.

Q17. *When the driver has some free time that they can use for training?*

Answers to Questions 17 and 18 would help the researcher assess how much free time most drivers can spare to take the training and how they currently use their free time.
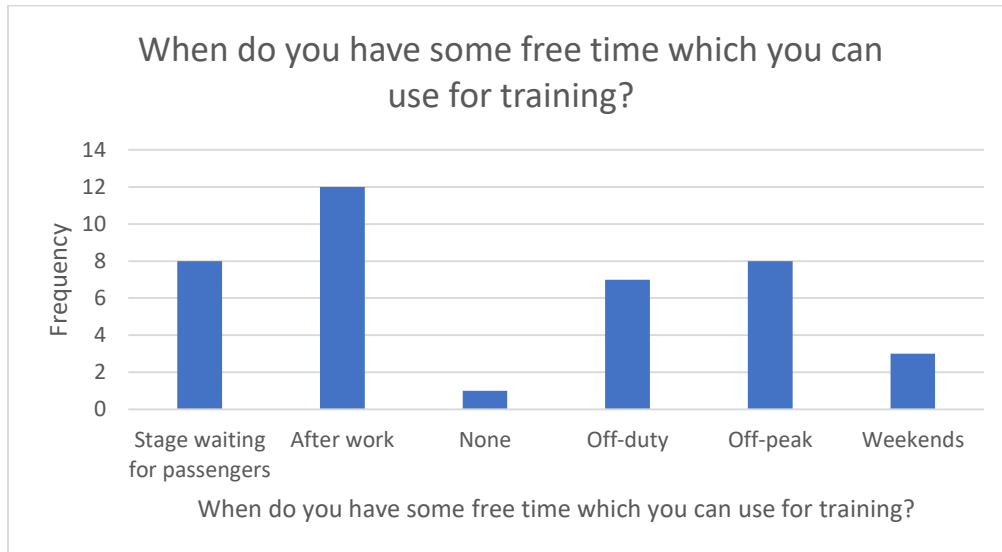
FIGURE 18 Driver free time.

Most drivers have some free time which they can use for training after work, while waiting for passengers at the stage, during off-peak or off-duty.

Q18. *How the driver usually uses their free time on a working day?*

FIGURE 19 Current use of available free time.

Most drivers spend their free time reading the newspaper or on social media. The drivers may have to sacrifice some current activities for online training.

Q19. Driver to identify their preferred training needs.

By establishing the driver training needs, the researcher sought to establish focus areas in the design of the E-learning Course.

FIGURE 20 Training needs for drivers.

Most drivers identified road safety, vehicle maintenance, and emergency response as their priority training needs. The researcher has prioritized these areas in the design of online training.

Q20.Whether the driver foresee any challenges with the online training?

This question was intended to pre-empt any foreseeable challenges with implementing the E-training and make appropriate recommendations to address the challenge.
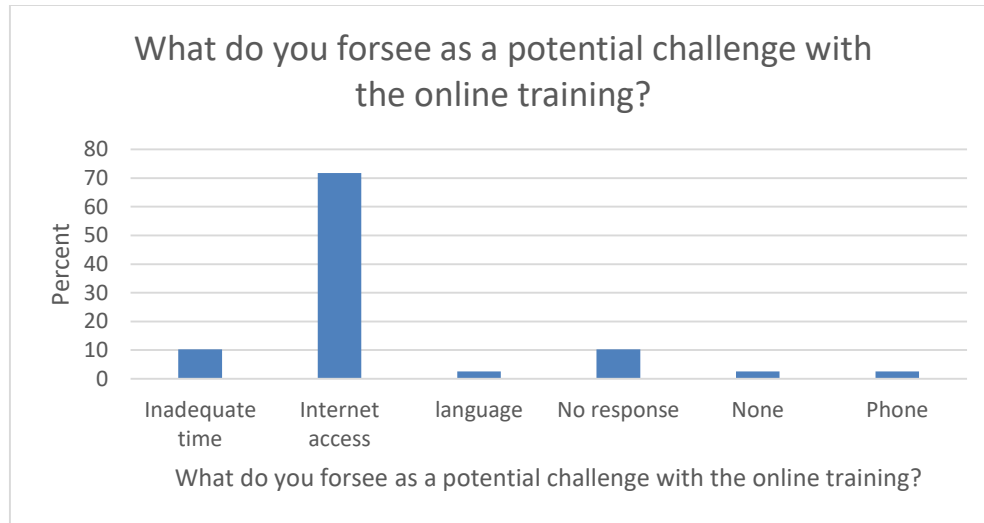
FIGURE 21 Potential challenge with online training.

Over 70 percent of the drivers identified Internet access as the critical potential challenge with online training. The researcher has made appropriate recommendations to SACCO operators to provide internet access for driver training.

Q21. *What will make the training interesting for the driver*

Questions 21 to 23 were intended to inform the E-learning course's design, make it interesting and captivating for the drivers, and motivate them to complete the training and practice what they learn.) Online course designers must appreciate learner expectations and motivation to inform the training course, thus addressing the learners' needs, and enhancing learner engagement, with higher course completion chances.
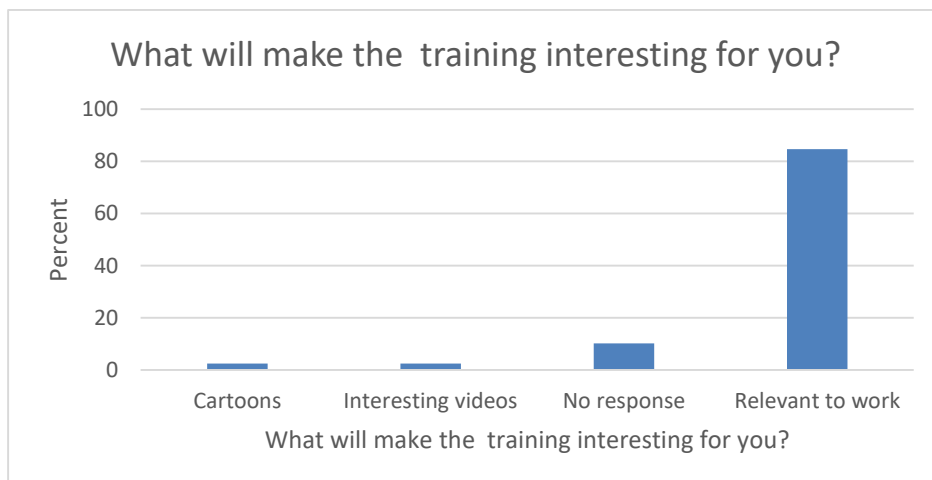
FIGURE 22 What will make the training interesting?

Over 80 percent of the drivers will be motivated if the training is relevant to their work. The researcher ensured that the course Modules are relevant to the drivers' work by focusing on the driver training needs.

Q22. What will motivate the driver to complete the training?
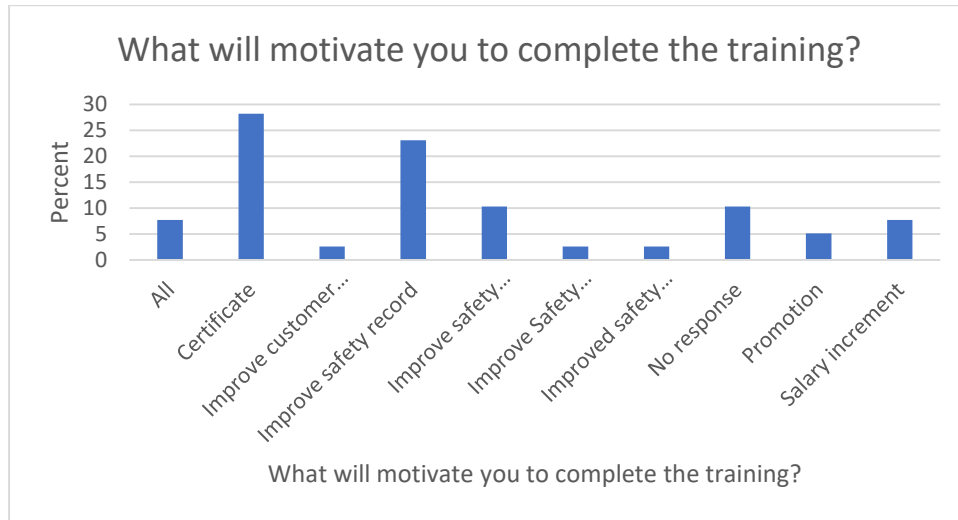
FIGURE 23 What will motivate the driver to complete the training?

Most drivers will be motivated to complete the online course if they expect a Certificate at the end of the training and if the training will improve their safety record. Drivers who complete the training course will receive a Certificate of Completion.

Q23. What will encourage the driver to practice what they learn?
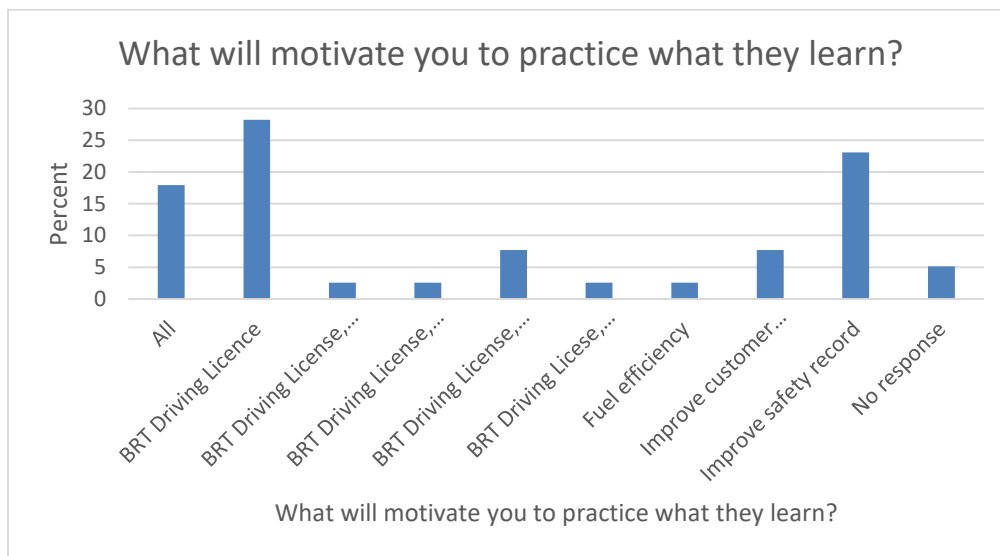
FIGURE 24 What will motivate the driver to practice what they learn?

Most drivers would be motivated to practice what they learn if they could be issued a BRT driving license and improve their safety records.

24.   **Other comments or suggestions**

Many drivers were happy to learn about the online training proposal and look forward to participating. In addition, the drivers would like training in defensive driving, road signs, customer care, bus driver and conductor rights, traffic rules, offenses and fines, drug abuse, and financial management. Other suggestions were that the training should be in Kiswahili and drivers should be well-remunerated based on international standards.

6   Development of an E-Learning Course for drivers

6.1   Course Overview

Informed by the primary and secondary data, the researcher designed an E-learning course for public transport drivers in the Nairobi Metropolitan Area. The E-learning course comprises three Levels/Modules, seven Topics, and seventeen Learning Moments, and each learning moment has between two to six steps, an average of four steps (questions/explanations). The three levels/modules are Bus Rapid Transit (BRT), Road Safety, and Emergency Procedures, as detailed in Table 2 below.

Each step includes questions, either multiple choice, multiple answers, multiple images, videos, or swapping. After each question, a detailed explanation is provided. At the end of each Module, a ten-question test covering the Module content is included to assess the learner's understanding of the content.
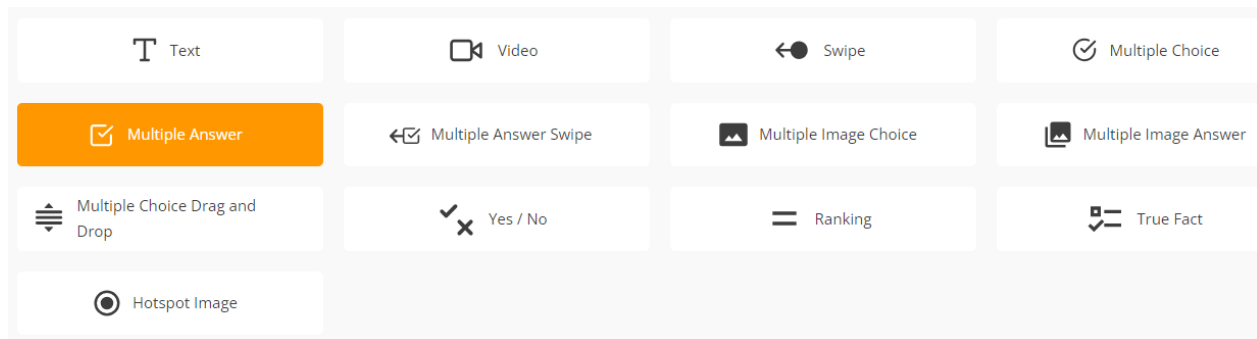
FIGURE 25 Step formats

Upon completion of the initial version of the E-learning Course, the researcher requested sector stakeholders to review the training and share their feedback which was incorporated to enhance the quality of the course.

TABLE 2 Summary of the online public transport training course

Lesson	Name	Content
Module 1: Bus Rapid Transit (BRT)		
Lesson 1	BRT Basics	The learner is introduced to the key characteristics of a BRT, the operation, and the infrastructure of a BRT system. The participant will learn about dedicated bus lanes, BRT stations, level boarding, priority junctions, depots, and terminals. For general knowledge, the lesson also highlights the first BRT in the world and BRT systems in Africa.
Lesson 2	BRT in Nairobi	This lesson covers the BRT Master-plan in Nairobi, discussing the gazetted five BRT corridors in Nairobi. The class also discusses the Nairobi Metropolitan Area (NMA), the five counties in the metropolitan, and the Nairobi Metropolitan Area Transport Authority (NaMATA) 's role in planning and implementing a safe and efficient public transport system in the NMA.
Lesson 3	BRT Buses	The learner is trained on the different capacities of BRT buses, bus doors, passenger information, priority area for persons with disability.
Lesson 4	Driving a BRT Bus	This lesson discusses how to dock at a median station, minimising space between bus and station, and bus doors operation. The class also emphasises the need to drive safely along the BRT lanes and BRT corridor intersections and touches on a BRT driver.
Module 2: Road Safety		
Lesson 5	Road Safety Statistics	This lesson overviews global, African, and Kenya road safety statistics. It also discusses vulnerable road users.
Lesson 6	Causes of road crashes	Safe driving, risky driver behavior, vulnerable road users, common causes of traffic crashes, how to avoid crashes, vulnerable road users, speed management

Lesson 7	Adverse driving conditions	Discusses driving at night and driving in rainy conditions
Module 3: Road Transport Emergencies		
Lesson 8	Types of emergencies	Examples of emergencies, how to respond in an emergency, assessing the emergency, and the need for regular bus crew training
Lesson 9	Emergency procedures	The lesson discusses what to do in case of a traffic crash and fire on board. Passenger safety, basic first aid, and Reporting. When evacuation necessary, and how should it be carried out. The lesson also discusses types of emergency equipment, fire emergencies, emergency information, and critical emergency contacts in Kenya.
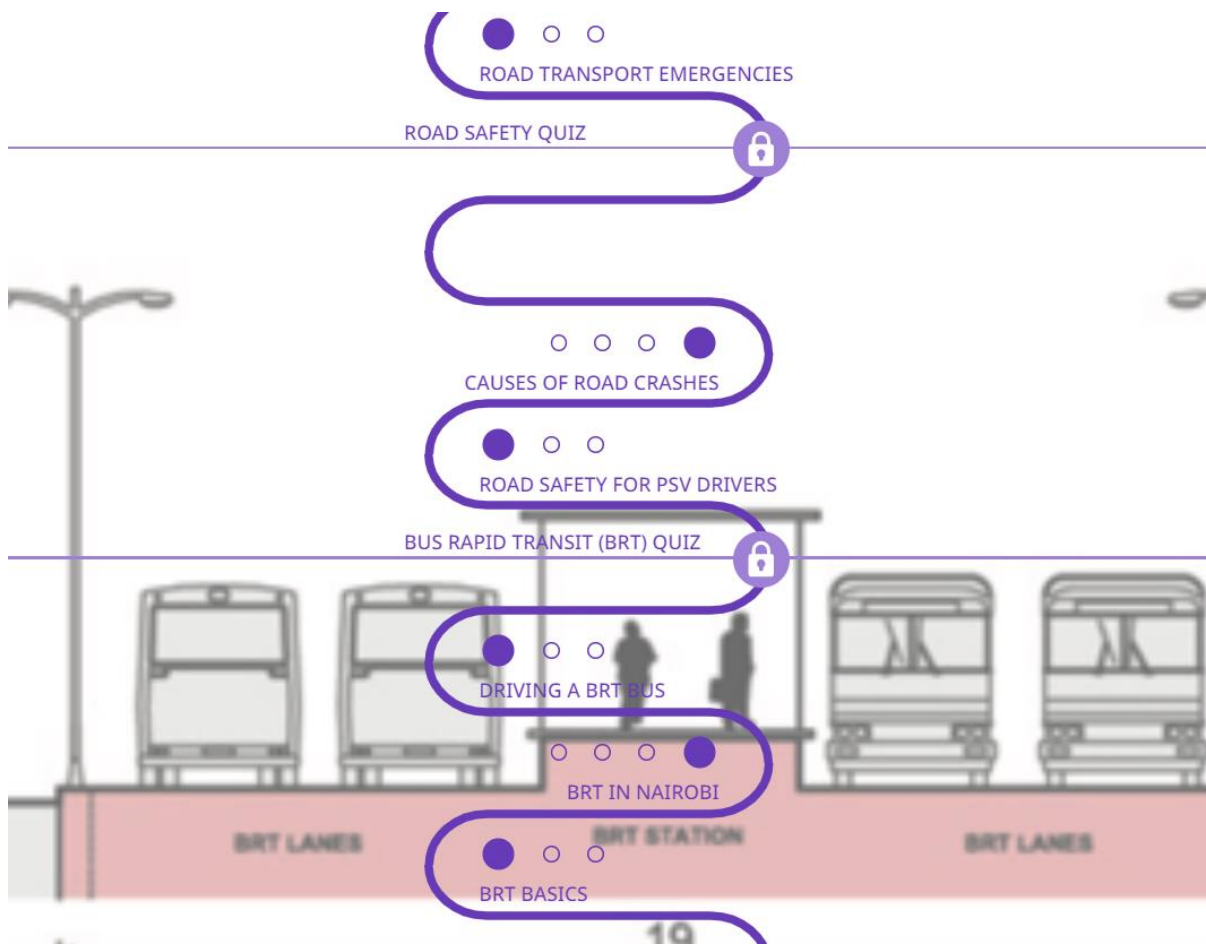
FIGURE 26 E-Leaning Course cover page.

6.2   Module 1: Bus Rapid Transit (BRT)

6.2.1   BRT Basics

- A Bus Rapid Transit (BRT) is a public transport system designed with services and infrastructure to carry many passengers safely, quickly, and efficiently.
- A BRT is a high-quality, high-capacity, high-speed, and customer-friendly bus system.
- A BRT system is designed to deliver fast, comfortable, and affordable urban transport.

Features of a high-performing BRT system:

The following features enable BRT to offer high capacity, high speeds, and safe and convenient access for all users.

- Dedicated Bus lanes;
    - o BRT lanes are physically separated from mixed traffic to prevent entry by other vehicles.
    - o The dedicated bus lanes are located in the middle of the road (median alignment)
    - o A physical barrier with a height of 400 mm is used to prevent other vehicles from accessing the BRT lanes.
    - o Buses move fast because they are not held up in mixed traffic.
    - o Buses also avoid interference by turning vehicles to property entrances, side streets, on-street parking, and pedestrian movements. Safety is enhanced due to reduced conflict with turning vehicles and pedestrians.
- Platform-level boarding;
    - o The floor of the bus is the same level as the station floor
    - o The station floor should be the same level as the bus floor for level boarding, reducing passengers' time to board and alight.
    - o Level boarding provides universal access (Umbrajkar and Manish, 2013).
- Off-board fare collection;
    - o Passengers pay their fare before boarding the bus
    - o Buses move faster because of multiple-door boarding and avoidance of queues for fare payment and validation.
- Improved convenience for customers

6.2.2   Intersection priority

- Intersections are designed to give priority to BRT buses
- Right-turning vehicles are not allowed in front of the BRT
- A two-phase signal minimises delays for the BRT system.
- Provide safe and convenient pedestrian access to stations.
- Minimise delays for mixed traffic.

6.2.3   BRT Infrastructure

Dedicated bus lanes

- Dedicated bus lanes are located in the middle of the road to allow faster movement of buses.

- Bus lanes are approximately 3.5m wide.
- Dedicated bus lanes are preferably made of concrete to withstand the heavy weight of large BRT buses.
- Some BRT designs provide an overtaking (passing) lane at the station, allowing an express bus to overtake a docked bus.

BRT Station

- A well-designed BRT system will have stations in the median serving both directions of bus movement.
- Spacing between stations of 500m is preferred to ensure that stations are not too far from adjoining neighbourhoods.
- The waiting area of a BRT station provides seating, lighting, and real-time passenger information.
- The ticketing area outside the station should include displays on available bus routes and schedules and a map of the station precinct.
- The station roof has an overhang over the bus to protect passengers from rain or intense sun during boarding or alighting.
- BRT stations should offer leaning bars and adequate circulation space for passengers.

BRT Terminal

- A terminal is a large station that provides transfers between BRT trunk and feeder routes or between the BRT system and paratransit (matatu) or intercity services.
- Individual bus routes often start or end at terminals.
- Terminal and interchange facilities require space for the buses to turn around and multiple bays for the routes that pass through the terminal.
- Terminals should also provide passenger amenities (retail outlets, automated teller machines (ATMs), public toilets), administrative offices, and space for off-peak bus parking.
- Terminals at corridor endpoints may be located along or slightly off the corridor.
- Good terminal design should minimise bus circulation and passenger movements.

Depots

- The primary purpose of a depot is bus storage/parking, bus repairs/maintenance, refueling/charging stations, cleaning, centralized management of the BRT corridor, and administration.
- Depots should be located along or next to a BRT corridor to minimize the "dead kilometers."
- "Dead kilometers" is the non-revenue/non-profitable (extra) distance buses cover to reach a BRT corridor endpoint.
- Depots are often located at or next to terminals to allow the use of depot parking for BRT vehicles coming out of service during off-peak periods.

Non-Motorised Transport

- Footpaths are necessary on both sides of the BRT corridor for passengers to walk safely to and from the BRT stations.
- Walkways and cycle tracks are provided along a BRT corridor
- Cycle tracks may be provided along the corridor for the safety and convenience of cyclists.

- A tree line is provided to protect people walking (pedestrians) from the intense sun.
- Motorized traffic, including cars, matatus, and motorbikes (bodabodas), should not use the footpaths as they endanger people walking on them.

6.2.4   BRT Buses

- BRT buses have wide doors on the station side of buses, allowing for fast boarding and alighting.
- BRT consists of trunk services (buses operating only on the dedicated BRT corridor) and direct services where buses continue beyond the corridor to the estates.
- Buses offering direct services will require doors on both sides, station side, and curbside (kerbside).
- Buses should meet modern emissions standards (i.e., at least Euro 4,5, 6, or electric).
- Buses may also be designed with attractive external styling and high-quality interiors to project an attractive image for the system.
- Stanchions, grab bars, and hand-holds should be provided for balance and support for passengers to hold during bumps or sudden stops that the bus may encounter.
- Priority seating is provided and reserved for people with disabilities, the elderly, mothers with small children, and pregnant women.
- Priority seating is next to vehicle entry doors to facilitate access from BRT stations.
- Stop request buttons are installed at priority seating locations and wheelchair positions.
- Auditory announcements of stop names and key destinations ensure that visually impaired people are facilitated to reach their destinations.
- Bus sizes include;
  - Standard 12m bus
  - 18m articulated bus
  - 24m bi-articulated bus

6.2.5   Driving a BRT Bus

- Driver performance plays a significant role in the success of a BRT system.
- Some BRT systems adopt 350mm (low floor), while others are 900mm (high floor) above the carriage level.
- For passengers to board and alight at the station, the BRT bus has a big door on the right that opens and closes at the same time as the station door.
- The bus also requires a door on the left side for boarding and alighting at bus stops along a mixed-traffic route (Umbrajkar and Manish, 2013).
- The correct door operation is essential to ensure the safety of passengers.
- The bus-stop doors on the left remain closed when the BRT bus is driving on the dedicated lane.
- The BRT driver should drive safely along the BRT lane.
- The driver should observe the speed limit on the bus lane and look out for crossing pedestrians and any encroaching vehicles.
- BRT buses will be given priority at intersections; however, the driver should wait for their turn to enter the intersection (Umbrajkar and Manish, 2013).
- A BRT driver should be well trained and thoroughly familiar with the BRT driving and operations before they can drive a BRT bus.

- BRT drivers should be issued a special license with a photo badge, which they should always display on their uniforms (Umbrajkar and Manish, 2013).

Pulling in and out of a BRT station

- While docking at a median station, the driver should minimise the gap between the bus and the station platform to avoid passengers falling in the opening, particularly children and elderly passengers.
- The platform should extend towards the bus to minimize the gap between the bus floor and the station platform.
- Kassel kerbs or alignment markings help guide the driver to park as close to the station as possible.

6.2.6 Nairobi Metropolitan Transport Authority (NaMATA)

- Nairobi Metropolitan Area Transport Authority (NaMATA) was formed through Gazette Notice No. 1093, dated February 17, 2017.
- NaMATA oversees the planning, implementation, and operations of an integrated, efficient, reliable, safe, and sustainable transport system in the Nairobi Metropolitan area.

6.2.7 BRT in Nairobi

The Mass Rapid Transit System (MRTS) Harmonization Study (2014) identified five BRT corridors for implementation in Nairobi alongside commuter rail rehabilitation and extension to enhance the public transport system (Gauff Consultants, 2014).

The five BRT lines include;

- BRT Line 1-Mombasa road-Waiyaki Way
- BRT Line 2-Thika Superhighway
- BRT Line 3-Juja Road-Race Course Road-Haile Selassie -Ngong Rd
- BRT Line 4-Jogoo Road
- BRT Line 5-Outer Ring Road
- Legal Notice 16 of 2019 declared the five corridors as BRT corridors

6.3 Module 2: Road Safety

6.3.1 Introduction

Global road safety

- Approximately 1.35 million people die on the world's roads yearly, while 50 million sustain life-changing injuries (WHO,2018).
- Road traffic crashes are the biggest killer of young people (5-29 years) worldwide and a significant cause of disability.
- Road crash fatalities are three times higher in Low and Middle-Income Countries (LMICs) than in developed countries.
- Over 90% of road traffic fatalities are in LMICs though the LMICs have about 50% of vehicles.
- "The High Toll of Traffic Injuries: Unacceptable and Preventable" (World Bank, 2018).

Road Safety in Africa

- Road traffic injuries and fatalities remain one of the biggest yet preventable health, economic, and social issues for most African countries.
- Africa reports the highest fatality rate due to road crashes, with 26.6 road fatalities per 100,000 populations, compared with a global average of 17.5 per 100,000 and 9.3 per 100,000 in Europe (WHO, 2018).
- Road Traffic crash is ranked the ninth cause of death in the continent, with approximately 296,000 residents dying on the road yearly.
- Poor road safety in Africa impacts the residents heavily due to the death and misery it causes and the loss of productivity due to severe injuries (ARSO,2021).
- Road crashes contribute to increasing poverty in Africa.

Road Safety in Kenya

- According to National Transport and Safety Authority (NTSA), Kenya lost 4,500 to road crashes in 2022 (NTSA, 2022).
- Most road crash victims on Kenyan roads are pedestrians (NTSA, 2022).
- Over 80% of the road crash fatalities in Kenya are young adult males (NTSA, 2022).
- Most of the crashes on Kenyan roads are due to speeding (NTSA, 2022).

Pedestrians are the most vulnerable road users.

- Most of the people killed on Kenyan roads are pedestrians, with most of them being hit by vehicles as they attempt to cross a road or a street (NTSA, 2022).
- Pedestrians are not protected like vehicle occupants.
- The lack of footpaths and safe crossing facilities and high vehicle speeds in built-up areas are the major causes of pedestrian deaths.

Cost of road crashes

- Road fatalities and serious injuries cost countries 3-5 percent of their Gross Domestic Product (GDP) due to related costs, including;
  - healthcare expenses,
  - emergency response services,
  - loss of a breadwinner,
  - loss of skilled workers,
  - reduced or loss of productivity,
  - damage to assets.
- In 2014, World Health Organisation (WHO) estimated Kenya's annual loss due to road crashes to be approximately 5 percent of its GDP, amounting to KES 387.5 Billion.

6.3.2   Safe Driving

Vehicle safety

- A vehicle should be equipped and in good condition for safe driving.
- A vehicle needs regular checkups and maintenance.

Low tire pressure

- **Uneven and faster wearing of tires**

    o   Low tire pressure causes uneven and faster wearing, requiring frequent repairs, maintenance, and replacement.
    o   With a flat tire, more tire surface is in contact with the road surface leading to faster wearing of the inner and outer shoulders. This results in worn-out tread and reduced tire traction.

- **Low tire pressure can cause tire failure and blowouts**

    o   A flat tire means more tire surface is in contact with the road surface, which can cause the rubber to overheat, resulting in a blowout.
    o   Tire blowouts happen suddenly, resulting in loss of control and possible crash. Blowouts often occur at high speeds, making them extremely risky.

- **Fuel inefficiency**
    o   Low tire pressure increases resistance, thus, higher fuel consumption.
    o   With low tire pressure, more tire surface touches the road increasing resistance, thus demanding more energy to move the car.
    o   Having the correct pressure in the tires impacts fleet fuel consumption and budget.

- **Compromised vehicle handling**
    o   The sides of a flat tire flex more during vehicle maneuvers such as braking, taking a corner, and steering than they are designed to.
    o   A flat tire increases braking distance, which is risky in an emergency as time is of the essence.

- **Hydroplaning**
    o   Flat tires increase the chances of hydroplaning (also known as "aquaplaning) when driving slowly.
    o   Hydroplaning happens when a vehicle drives over a wet road surface or a pool of water and loses contact with the road surface leading to loss of traction and steering.

Checking tire pressure

A combination of visual and manual checks and monitoring technology will ensure your tire pressure is good.

- Drivers and maintenance teams should visually inspect tires every morning before driving the vehicle.
- The tire pressure gauge will give you the accurate tire pressure
- Ensure the tire pressure monitoring system (TPMS) is working.
- Most vehicles are fitted with a TPMS; a light will appear on the dashboard if the tire pressure is low.
- TPMS needs replacement after 5 to 10 years, and this should be checked during maintenance
- Fleet vehicle tracking system: Fleet tracking systems include maintenance features to track issues such as tire pressure.
- How much pressure is correct? Most vehicles require 32 psi to 35 psi.
- This information is available in the owner's manual, the driver-side door sticker, or the tire itself.

Inspect the outside of the vehicle.

- Ensure **rearview mirrors** are clean, in good working condition, and can see at least 200ft.
- **Windows** should be clean to enable clear sight.
- **Vehicle lights** should be checked regularly to ensure they are working correctly.
    - Headlights
    - Tail lights,
    - Turn signals
    - Stop lights
    - License plate lights
    - Parking lights
- Check that the wipers are in good condition
- Check the mufflers. They reduce noise and air pollution from vehicles.

Inspect the inside of the vehicle.

- **Engine tune-up:** Spark plugs, condenser, distributor points, carburetor, and air filter should be replaced regularly.
- **Battery**: Should be well maintained by adding distilled water when the level is low.
- Safety devices such as **fuses and circuit breakers** should be regularly checked and maintained.
- **The radiator level** must be checked, and coolant added if below the minimum allowed.
- **Brakes** should always be in good working condition.
- **Temperature gauges, brake fluid,** hose connections, and master cylinders must be checked often.

6.3.3   Drivers physical condition

To ensure safe driving, the driver should be physically, emotionally, and mentally sound.

Vision

- Decisions during driving are informed by what the driver sees.
- A driver should see swiftly, clearly, and accurately.
- Late sight delays decisions and actions by the driver.

- Poor eyesight should be corrected using corrective glasses.
- Regular eye-checkup is vital for a public transport driver. If glasses are needed to correct eyesight, they should be worn before starting every trip.
- Do not wear sunglasses at night or in low visibility

Smell

- Through smell, a driver can tell if there is some gas leakage in the car.
- Carbon monoxide poisoning may lead to drowsiness, headaches, nausea, or mental dullness leading to impaired driving.
- Check the engine and exhaust to ensure they are in good working condition

Hearing

- Hearing challenges may prevent a driver from hearing essential sounds such as an ambulance, fire engine, hooting by other vehicles, or some unusual vibrations in the car.
- Hearing aids may be used where necessary to improve hearing.

Touch

- Safe driving requires proper coordination of hands and feet to keep the vehicle in control during motion.
- Through the sense of touch, the driver should detect any defects in steering, accelerator, brakes, lights, and signals.

Emotions

- Emotions affect the way people drive and may cause errors resulting in crashes.
- **Anger** interferes with braking and acceleration due to changes in body functions, such as heartbeat.
- **Anxiety** may lead to panic decisions or actions.
- **Excitement,** such as stress and excess happiness, may change some body functions, influencing decision-making and interfering with safe driving.
- **Fatigue** is a common challenge with drivers.
  - Fatigue makes the mind dull and impairs nerves and muscular responses
  - Fatigue may result from
    - inadequate sleep,
    - excessive physical exercise
    - Mental or emotional stress
    - Driving for too long
    - Extended duration of the same task (monotony)
    - Driving during your sleep time
- A good driver should learn to control and cope with emotions for safe and effective driving.

To avoid fatigue

- Get adequate sleep before driving
- Avoid driving during your sleep time
- Balanced diet at regular intervals
- Maintain fitness
- If you feel tired, take a rest before starting a journey
- Do not drive when on medication which is likely to make you drowsy

6.3.4 Safe driving tips

Speeding

- Observing the speed limit is one of the most cost-effective strategies for reducing road crash fatalities and serious injuries (WHO, nd).
- Every 1 km/hr increase in speed results in a 3 percent increase in road crash risk and a 5 percent increase in fatal crash risk (WHO, nd).

Driving at night

Visibility can be poor if you drive at night or in rainy conditions despite your headlights. Reduce your speed at night, especially in dark sections of the road or in rainy conditions.

- Best turn on your headlights at sunset
- Avoid full beam as it blinds oncoming vehicles and other road users
- Use full lights in the open country where there are no oncoming vehicles or pedestrians
- Dim headlights when there is an approaching vehicle or when following another vehicle
- Reduce driving speed at night
- Allow adequate space between your bus and the vehicle ahead
- Drive as far as possible (to your side) if an oncoming vehicle has one headlight
- Driving in a brightly lit area, slow down to allow your eyes to adjust to the lighting.
- Avoid looking directly into the glare of oncoming traffic. Instead, look at the road marking on your side, keeping watch of oncoming traffic through the corner of your eye.
- Do not wear sunglasses when driving at night.
- Switch to full beam, then to low beam as you start overtaking to warn other drivers of your intention to overtake.
- For long drives- do not drive if you feel tired and sleepy
- Singing or conversation or stopping, stretching, or walking around can help to keep you awake and alert as you continue driving
- If you feel sleepy, stop the vehicle at a safe location and take a short nap.

Driving in a storm

- Rainwater makes the road pavement slippery and affects vehicle stability.
- A heavy downpour may cause pooling, requiring careful and slow vehicle maneuvering.
- Rain makes the windscreen, headlights, mirrors, and taillights blurred and dirty.
- Turn on your headlights to improve visibility.
- Slow down when it starts drizzling. Road pavement becomes most slippery at this point due to the oils and dust on the pavement.
- Driving on flooded roads may affect your braking. If this happens, test your brakes thoroughly to dry them out (once you are out of the flooded section).
- Avoid instant stopping, turning, and starting the engine.
- Increase the following distance.
- Keep your windscreen clean with the wipers.

Avoid distractions

- Total focus on driving is critical to safety, as even minor distractions can result in a crash and serious injuries or death.

Use of mobile phones while driving

- Using mobile phones, whether handheld or hands-free, increases the chances of a crash resulting in serious injuries or fatalities.
- Reading, writing text, or dialing on a mobile phone has an even more considerable risk of a crash.
- The threat is more severe for inexperienced young drivers than older, more experienced drivers.

To avoid distractions

- Complete personal grooming and plan your trip before leaving the house
- Fix your radio and temperature before starting your journey
- Form a habit of pulling up to pick up any call that cannot wait
- Keep away from reading materials if they tempt you to read
- Avoid complex or emotional conversation as you drive as it will impact driving

Driving and alcohol

- Drunk driving is not safe. "If you drink, DO NOT drive."
- Driving a vehicle requires total concentration. Alcohol makes it hard to concentrate and pay attention to details on the road.
- Alcohol slows down the mind making it difficult to respond promptly to situations on the road.
- Alcohol interferes with good judgment on driving speed and distance from other vehicles and road users.
- Alcohol gives false confidence and can result in risky driving.
- A drunk person loses a sense of balance.
- Drunk driving increases the chances of road accidents and possible death or severe injuries to passengers or pedestrians.
- The risk of a road crash increases significantly if a driver has a blood alcohol concentration (BAC) of 0.04g/dl or above.
- Young, inexperienced drivers with a BAC of 0.05g/dl have 2.5 times higher chance of a crash than a mature experienced driver (WHO,2015).

6.3.5   Road Courtesy

Other motorists

- Allow safe movement of other road users, including cyclists, motorcyclists, and pedestrians.
- Give proper signals to other motorists on your intention to turn (left or right), slow down, overtake, or slow down.
- Keep a safe distance from the car ahead. Avoid tail-gaiting.
- Park in an orderly and courteous manner. Allow those who arrived first to park while you wait for another space.

- Park in a way to enable other vehicles adequate room to park or to pull out of the next parking.
- Allow room for vehicles that intend to overtake.

Passengers

- Follow traffic signs and signals, and regulations.
- Avoid unnecessary emergency brakes, as this may cause injuries to your passengers.
- Wait until all passengers have fully boarded or alighted before moving the vehicle. You could injure your passenger by moving when they are still boarding or alighting.
- Do not smoke or eat miraa (khat) while driving.
- Ensure that the bus conductor treats your passengers appropriately, including using polite language, giving the correct change, and assisting sick or persons with a disability.
- Avoid distraction from a passenger as you drive.

6.3.6   Vulnerable road users

Drivers must be on the lookout for the following vulnerable road users;

Pedestrians

- "Vulnerable road users" refers to "walkers or pedestrians and cyclists (bicyclists and motorcyclists) who are easily injured and killed in a car-dominated road space" (Khayesi, 2020)
- Most road crash victims on Kenyan roads are pedestrians (NTSA,2022)
- According to National Transport and Safety Authority (NTSA), Kenya lost 4,432 to road crashes in 2022 (NTSA, 2022). Thirty-six percent of the road fatalities were pedestrians.
- Pedestrians are the most vulnerable road users because
  - They are not protected like vehicle occupants
  - Roads in Kenya lack footpaths and cycle tracks
  - Lack of safe crossing facilities
  - High vehicle speeds in built-up areas with heavy pedestrian traffic (WHO, 2018).
- According to a study by NTSA in collaboration with Kenya Police Service, approximately 35 percent of road crash fatalities happen within 20m from matatus/bus stages, highlighting the unsafe behaviour of paratransit drivers.

- Pedestrians are not visible in the evening, especially if the street is not light. Always slow down in areas with high pedestrian traffic.
- Look out for pedestrians walking on the side of the road or crossing the street.
- Stop for pedestrians to cross the road.
- Do not drive on the pedestrian walkway or cycle track.

Children

- Speed contributes up to half of road fatalities in low- and middle-income countries. Long, straight roads next to schools, residences, and businesses facilitate high speeds and expose children to significant risk.

Why are children most vulnerable on the road?

- Drivers need to be alert, especially when driving near schools.
- Due to their small body size, children do not see much and are often not visible to vehicle drivers.
- Children have softer heads and suffer more severe injuries than adults in crashes.
- Due to limited traffic experience, children cannot interpret what they see or hear and may not judge accurately the speed and proximity of a vehicle.
- Young children can only concentrate briefly and cannot focus on more than one activity at a time.
- Adolescent children are playful and take risks exposing them to safety risks on the road.
- Thirty-eight percent of children killed on the roads are pedestrians.
- Most child fatalities on the road occur in middle and low-income countries where walking and cycling facilities are lacking. Children are forced to walk next to fast-moving cars exposing them to safety risks.

Older adults and PWD

- Older adults stroll and may not see or hear well.
- Drivers should allow less abled persons, including older adults, persons with disability, and sick persons, to cross the road.
- Persons with disability (PWD)-Visually impaired or in a wheelchair cannot move fast. Give PWD ample time to cross the road.
- Do not hoot at them.

6.3.7   Fuel saving tips.

- Avoid revving your engine just after starting. Wait for the engine to warm up, as a warm engine saves fuel.
- Take-offs and sudden stops lead to high consumption of fuel. Gradual acceleration saves energy and reduces wear and tear.
- Keep the correct tire pressure. Low-pressure tires lead to higher fuel consumption; tires wear out faster, making handling the vehicle difficult.
- Change to higher gear as soon as possible. Higher gears consume less fuel than low gears.
- Smaller cars (engines) consume less fuel than bigger vehicles
- Plan your trips to avoid congested routes that will lead to delays.
- Avoid parking in the sun as the fuel evaporates rapidly when a vehicle is parked there.
- Avoid unnecessary luggage in the car as it contributes to higher fuel consumption.
- Avoid filling the gas tank to the brim to allow space for expansion and avoid wastage.

6.4   Module 3: Emergency procedures

- During an emergency, the bus driver should manage and assess the situation and take appropriate action if they are not seriously hurt.
- Managing a crisis can be stressful and confusing; therefore, clear policies and training are needed to implement the procedures.
- Public transit and bus crews must be well-prepared for emergencies.

6.4.1   Examples of emergencies

- Vehicle crashes involving BRT Bus;
- Fire in the Bus;
- Employee injuries;
- Passenger fall or injury;
- Transit facility fire;
- Release of hazardous material in a bus or transit facility;
- Pedestrian hit by transit bus;
- A dangerous passenger on a bus;
- The dangerous passenger in a transit facility;
- Suspected items in a bus or transit facility.

6.4.2   Who is responsible

- Dispatchers, supervisors, bus drivers, and conductors.
- A response should be instant without hesitation to save lives, equipment, and other assets.
- They can only do this if they are trained in emergency procedures.
- Emergency procedure documents should be readily accessible in the vehicle-should have procedure processes and a checklist on how to respond in different emergencies.
- Transit staff must respond in a calm, effective, and timely manner.
- Bus drivers and conductors and the first responders to emergencies.
- Easy-to-use checklists should be readily accessible to the transit crew and their supervisors.
- A bomb threat checklist should be on every worker's phone.
- The updated procedure guide should be on the desk of the dispatcher.

6.4.3   In an emergency, the bus driver will;

- Bring the bus to a stop;
- Try to remain as calm as possible;
- Activate hazard signals;
- Notify dispatch through radio;
- Decide whether to evacuate passengers;

6.4.4   Emergency information

- Emergency telephone contacts for the ambulance, police, fire station, and dispatch should be written on a card readily available to the driver and the conductor.
- When calling for help, provide this information;

- o   Location-nearest landmark;
- o   Nature and seriousness of the emergency;
- o   Assistance required (Police, fire services, or ambulance);
- o   Whether the bus will be evacuated.

6.4.5   Assess the situation

- Whether it is safe to continue driving;
- Whether it is safe for the bus to remain in its position;
- Whether to evacuate passengers;
- Evacuation should be done through the emergency exits windows and doors;
- Regroup at a safe place near the bus; passengers are safer on the bus if the situation allows.

6.4.6   Safety equipment

- Safety equipment can assist the bus crew in responding to emergencies
- Bus crew should be trained on how to use the equipment
- During a pre-trip inspection, ensure all safety equipment is in place and in good working condition

List of safety equipment in a bus;

- Reflective jacket -the bus operator is visible to other road users at night.
- Torch - for investigating incidents at night and pre-trip inspection.
- Warning triangles - alerting oncoming vehicle drivers of the crash/incident.
- Web cutter - located next to bus operators' seat-used to cut their safety belts to assist other passengers.
- First aid kits are used to treat minor injuries.
- Bio-hazard kit - for containing spills until the vehicle is switched off, cleaned, and disinfected.
- Fire-extinguisher should be fully charged and in good working condition. Types AB and ABC are used to curtail fire to allow bus crew and passengers to evacuate the vehicle.
- If there is smoke or fire in the bus, always evacuate the passengers first.
- During fire events, toxic gases rise to the ceiling- this must be considered when evacuating passengers from a bus on fire.

6.4.7   Bus information

- The bus driver and conductor should know essential information about the bus to assess an emergency.
- Location of emergency doors and how to operate them.

6.4.8   Evacuating passengers

- Evacuation is necessary if there is a danger of a hazard.
- Risk of fire, the smell of leaking petrol, if the bus can be hit by another vehicle.
- Passengers should be safe from speeding traffic, bad weather, or dangerous zones.
- Would moving passengers complicate their injuries, for example, neck or back?
- Risk of a hazardous spill. The driver may decide to keep passengers on the bus.
- In case of fire in the bus, remember toxic gases tend to rise and crawl through the smoke.

- Communicate clearly to passengers before evacuation.

6.5   Testing the Training Module

After completing the E-learning Course, the researcher requested ten sector stakeholders to review the training and give feedback. The stakeholders included; SACCO officials, matatu drivers, transport engineers and planners, and a user, as summarised in Table 3 below.

TABLE 3 List of stakeholders who tested the training course and provided feedback

Stakeholder position	Number of stakeholders
Two drivers	2
SACCO/Company Operations Director	1
Transport Engineers	3
Transport Planners	3
Public transport user	1
Total	**10**

6.5.1   Stakeholder feedback

Most stakeholders required some initial training on how to access training course in the Application and navigate through the training. Generally, the professionals did not experience challenges opening the training course on their laptops or phones since most have strong, dedicated Wi-fi in their offices or at home. Drivers experienced some difficulties opening the Application on their phones using data bundles. The researcher organised individual meetings with the two drivers in a location with strong Wi-fi and trained them to open the Application and navigate through the training.

The following is a summary of the stakeholder feedback;

- Most stakeholders thought the training was well thought out, detailed, and comprehensive, with substantial research into the course's design.
- The training is simplified, easy to understand and to navigate through. It picks the critical aspects of each topic, making it better than reading a write-up.
- The E-training slides are interactive, appealing, and engaging. The mix of colors gives the training a good touch. The compliments at the end of every question are encouraging. The option to redo the question is helpful.

- One respondent commented, *"Even as a sector professional, I found a lot of data and information I did not have, such as the percentage of children dying on the road."*
- This training is good as it makes professionals in the public transport sector research more as they attempt to answer some of the questions in training.
- Emergency contacts provided in training are handy.
- Training on the evacuation of passengers is essential
- If the training course is well implemented for PSV drivers and conductors in the country with some of the suggested activities outlined in the course, road safety in the country will likely improve.
- It is easier to navigate using a phone than a laptop.

Suggested areas of improvement

- The training was initially locked after level 1. After the feedback, the researcher unlocked it to allow the learners to progress.
- Source of photographs, videos, and GIFs should be provided
- BRT Line 5 connects with all the remaining four Corridors-Lines 1,2,3, and 4.
- Check questions on risky driver behavior.
- Road safety should be introduced in the school curriculum to raise awareness at all levels, and children to grow up knowing these facts.
- The side of BRT vehicle doors will depend on the driving code for each country.
- A Certificate should be issued after the final score. If a learner wants a Certificate, they should take this test (it can be optional).

6.6 Certificate of completion

A Certificate of completion will be issued to a learner who completes the training and passes the final test. This Certificate will be helpful when the learner is applying for future jobs, thus motivating the drivers to take up the online course and complete it.

- To complete the course with a Certificate, the learner must achieve a set minimum score of 80 percent.

- The learner can download and send the Certificate to their email and print it out.

7 Discussions

7.1 Discussions

This study reveals that despite the introduction of an elaborate curriculum for driver training by NTSA in 2016, the road safety situation in the country continues to claim thousands of lives annually, with the majority of victims being young, economically productive males. Existing literature indicates that public transport vehicles significantly contribute to Kenya's declining road safety situation, with approximately 70 percent of the severe injuries attributed to public transport.

Most SACCOs confirmed that they do not provide continuous driver training and rely entirely on driving school training. SACCOs/Companies that used to provide training before COVID-19 are no longer doing so due to the limitation of resources, as the sector has yet to recover fully from the impacts of the pandemic. In this study, SACCO/Company officials noted that currently, there is no special training for public transport drivers. They proposed the following as the priority training needs for drivers; road safety/defensive driving, awareness of other road users, passengers' safety, customer service/public relations, driving BRT buses, traffic code, laws and regulations, driver health, emergency procedures and first aid, and basic mechanics.

Both officials and drivers are pleased to hear of the proposed E-learning for public transport drivers. One bus operating company official responded: *"This training is excellent, and as many public transport drivers as possible should go through the training." The training should be easy to follow-simple with a mix of English and Kiswahili.* Government should leverage the positive feedback and support the implementation of the E-training program.

To motivate the drivers to take the training, complete and practice what they learn, the SACCO officials suggested that drivers should be issued with Certificate upon completion of the course, which can be considered during the recruitment of BRT drivers; incentives for best-performing drivers, off duty, special awards for best performers, and assurance of better employment terms. Close monitoring of performance, a reward for best performers, improved employment terms, and some level of enforcement will motivate drivers to practice what they learn. SACCO officials were confident that their drivers had adequate training time. Ninety percent of the drivers have smartphones and can access the internet through data bundles. Although less than 20 percent of the drivers are dissatisfied with the quality of the internet, Internet access was seen as a potential challenge in implementing the online driver course, as SACCOs do not provide Wi-Fi in vehicles, and most drivers access the internet by purchasing data bundles from local internet providers.

Most drivers are young, 30-39 years, secondary school leavers, and they can easily be trained through the online platform without the challenges of technology use. Drivers can spare some free time to study at the stage while waiting for passengers, during off-peak, after work, or during off-duty. The drivers prioritised road safety, vehicle maintenance, and emergency response as their top training needs, and over 90 percent are keen to learn about BRT. Key motivators to take the training, complete, and practice would be training that is relevant to work, a Certificate at the end of the training, a BRT Driving license, and an improved safety record.

Many drivers were happy to hear about the online training proposal and are looking forward to partaking in training. The drivers would also like to be trained in other areas, such as; road signs, customer care, and traffic regulation. Another suggestion is that there should be a Kiswahili version of the training.

The researcher identified the following gaps in driver training;

- Lack of special training for public transport drivers.
- Lack of a policy on continuous training for public transport drivers
- No training for bus conductors, yet they are constantly interacting with passengers.

The Online learning course for public transport drivers will close the gap in post-license continuous training for drivers. E-Learning is cost-effective, flexible, and accessible on the phone. The training can easily be scaled up to reach thousands of PSV drivers in the Nairobi Metropolitan, the whole country, and the region. Most drivers have smartphones and internet access and are keen to learn more about BRT and improve their road safety records. With constant monitoring to assess the progress of each driver, the right incentives in place, such as a Certificate at the end of the course, recognition and promotion, or better employment terms for best-performing drivers, drivers are likely to take the training to completion and practice what they learn.

8 Conclusions and recommendations

8.1 Conclusions

The researcher noted that most SACCO/paratransit operation officials and their drivers appreciate the need for training. Most drivers indicated they would be motivated to train if the training is relevant to their work and can improve their safety record. Most drivers would be encouraged if the training could guarantee employment in the future of Nairobi BRT with improved terms of work. However, most SACCOs do not provide on-job training for drivers and therefore rely entirely on pre-license driving school training, contributing to the country's poor road safety situation, with public transport vehicles in the lead.

A policy on continuous training and testing of public transport drivers is necessary to enhance road safety in Kenya. Every public transport driver should receive post-license training periodically (annually) to improve driver road safety record, ensure that the drivers are up to date with the traffic laws and regulations, and keep the drivers well updated with the emerging traffic safety technology. PSV drivers' licenses should be reviewed annually, and drivers should earn Continuous Professional Development (CPD) points through continuous training. Training can be in English and Kiswahili so drivers can train in their preferred language. Bus operation companies should be encouraged to introduce a performance-based award system for best performing and safest operators/drivers to motivate safe driver behavior. The Government should support such programs to improve road safety in the country.

Public transport bus/matatu conductors urgently need appropriate training as they are constantly in contact with passengers. NTSA should therefore consider developing a training curriculum for conductors covering, among other areas, customer service, communication, safety for passengers, infectious diseases, substance abuse, and emergency procedures.

SACCO officials were confident that their drivers could spare adequate training time. To motivate the drivers to take the training, complete and practice what they learn, the SACCO official suggested that drivers should be issued with Certificate upon completion of the course, which can be considered during the recruitment of BRT drivers; incentives awards for best-performing drivers, off duty, special for best performers, alerts to take the course, assurance of better employment terms. Close monitoring of performance, a reward for best performers, improved employment terms, and some level of enforcement will motivate drivers to practice what they learn.

Internet access was reported as a potential challenge in implementing e-learning courses as 80 percent of the driver access the Internet by buying data bundles from Internet providers, as a few vehicles are fitted with free Wi-fi. Approximately half are satisfied with the quality of the internet. Over 90 percent of drivers have smartphones. The drivers confirmed that they could spare time to train while waiting at the stage, during off-peak, after work, or during weekends. The priority training needs include road safety, vehicle maintenance, and emergency response.

8.2   Recommendations

Initiatives by the Kenya government to enhance training for drivers in Kenya are commendable. However, considering the declining road safety situation in the Country and the high rate of involvement by public transport vehicles, much more needs to be done to improve driver behavior and create more safety awareness. The following are the researcher's recommendations based on these research findings;

8.2.1   Recommendations to the National Government

There is a need for better employment terms for public transport drivers. This should include a job contract with a salary and social benefits, including leave days, social security, medical cover, personal accident cover, and pension. One driver suggested that the drivers should be well remunerated based on international standards.

Government policy and an appropriate curriculum for continuously training public transport drivers should be developed.

8.2.2   Recommendations to NTSA

NTSA should adopt the E-training Curriculum developed by the researcher for continuous training for PSV drivers. NTSA should leverage the widely accessible mobile and internet access in the country to scale up public transport driver training throughout the country. Adoption of e-learning, and in particular micro-learning, is recommended as it is cost-effective, flexible, can be personalized, and it is scalable.

As proposed by the SACCO officials, public transport vehicle drivers require special training beyond the regular training in a driving school. NTSA should introduce a special curriculum for public transport drivers, including the following proposed areas;

- o   Road Safety/Defensive driving;
- o   Road signs;
- o   Customer care;
- o   Traffic rules, offenses, and fines for driver and conductor rights;
- o   Substance abuse;
- o   Financial management.

Public transport bus/matatu conductors urgently need appropriate training as they are constantly in contact with passengers. NTSA should therefore consider developing a training curriculum for conductors covering, among other areas, customer service, communication, safety for passengers, infectious diseases, substance abuse, and emergency procedures.

SACCO officials and drivers foresee internet access as a potential challenge in implementing the e-training for drivers. Considering the importance of online training in addressing road safety in Kenya, NTSA can partner with the Metropolitan Counties to provide free internet at matatu stages. Bus operators should also be encouraged to install Wi-Fi in their buses.

8.2.3   Recommendation to NaMATA

The online BRT training Module should be adopted and combined with practical driving in selected driving schools.

With the BRT implementation at an advanced stage, it is recommended that a detailed training curriculum for BRT drivers and operators should be developed and a special license introduced for future BRT drivers. Drivers with experience driving higher-capacity buses can be prioritized for training as BRT drivers.

8.2.4   Recommendation to SACCO operators

About eighty percent of the respondents access the Internet by buying data bundles. The researcher recommends that public transport operators/SACCOs consider providing Internet in their vehicles and offices as part of their training budget.

SACCO/Companies should be encouraged to develop a policy for continuous training of drivers. The operations managers should monitor to see who has completed and earned the Certificate and who has not and take appropriate action such as more support for the learner who has not achieved the Certificate.

Bus operation companies should be encouraged to introduce a performance-based award system for best performing and safest operators/drivers to motivate safe driver behavior. The Government should support such programs to improve road safety in the country.

8.2.5   Recommendation to Internet providers

Local Internet providers should be encouraged to boost their Internet at the critical bus stops/stages to facilitate ease of Internet access for driver training. It will be a win-win situation as the internet providers stand to benefit from increased internet usage for training purposes.

8.3   Limitations and future research

8.3.1   Limitations

Developing the E-learning course for Public transport drivers requires substantial time to assemble training content, design or search for suitable graphics, videos, and presentation slides, and develop the Course. Time was a significant constraint in creating the E-Course for public transport drivers. The researcher limited the number of respondents during data collection to overcome this challenge.

Nairobi is in its early stages of transition from Paratransit (matatu/bus) to the planned Bus Rapid Transit (BRT) system. Most matatu/bus SACCOs/companies are suspicious about the proposed BRT, fearing that BRT might drive them out of business. Some matatu SACCOs/Companies were reluctant to share information regarding their operations. The researcher used known networks in the industry to facilitate the data collection process.

Most matatu/bus drivers in Nairobi are busy during the day, making as many trips as possible to maximize their income. The drivers are on the road most days, and time for data collection was therefore limited. Whereas the researcher initially expected to collect data from 50 matatu drivers, only 39 responded. Some SACCO officials needed to be facilitated to assist with the data. Future research involving more drivers, say 500, may enhance the quality of data collected.

While E-learning will provide functional theoretical post-license training for public transport drivers, it is limited on the practical aspects of driver training. Partnership with driving schools will be necessary to offer periodic practical driving training, for example, once a year, for the learner to practice what they have learned in the E-learning course.

The availability of the stakeholders to test the course presented a challenge as most stakeholders are engaged in their work, and the e-learning Course was unfamiliar to them. It took some effort and consistent follow-up to get some stakeholders to complete the course and give their feedback. However, the researcher received positive feedback from the stakeholders who took the training. The researcher expects stakeholders to be more receptive as they become more familiar with micro-learning.

8.3.2   E-learning Course implementation

Given most stakeholders' busy schedules, careful planning and close monitoring will be necessary to ensure a successful implementation of the E-learning course. The researcher proposes the following measures;

The E-learning course comprises three Levels/Modules, seven Topics, and seventeen Learning Moments, and each learning moment has between two to six steps, an average of four steps (questions/explanations). A learner can cover two steps if they can spare about 30 minutes daily, adding to five steps or 2.5 hours per week. Depending on their schedule and preference, the learner will decide whether to spread the training to five days or work for more time during their off days. With such a schedule, the learner can complete the training in about 2.5 months.

Initially, drivers will likely experience training challenges as they are unfamiliar with the online training course. They will require some initial training on how to access the training and navigate through the course.

Considering their busy schedule, drivers can easily forget to take continuous online training. The drivers can be advised to set an alarm to remind them to take the course in their preferred free time. Their Supervisors will need to monitor closely how each driver is progressing with the training. If a learner is lagging, the Supervisor can contact them to find out whether they could be experiencing some challenges and can offer assistance. Every quarter, the SACCO/company can issue Certificates to the drivers who have completed the E-Learning Course, thus encouraging other drivers to take up the training to completion. The SACCO/Company can also introduce awards for best-performing drivers in safety record, customer service, and efficiency, among other performance indicators. Feedback from the drivers can be used to enhance the quality of the online training.

A Continuing Professional Development (CPD) points system can also be introduced where each driver should be required to achieve a certain number of CPDs per year, say 50 CPDs. Each driver should be required to spend a certain number of hours per week/month on training, earning them CPD points. A driver should accumulate at least 50 CPD points annually as a condition for renewing their PSV license. The drivers can set up a reminder to take their training and update them weekly on the number of CPDs they have achieved and the balance for license renewal at the end of the year. Each driver will choose the time of day or week when they are free to take the training and will set the alarm to remind them to train to ensure they achieve at least 2.5 hours/two learning moments per week.

8.3.3   Future research

Future research can be undertaken to assess the uptake of the E-learning Course for public transport drivers, the completion rate, and the impact on road safety record for trained drivers. Suggestions from the drivers on how to improve the course will assist in continually improving the course's quality and uptake.

For drivers who prefer using Kiswahili, the online training can, in the future, be translated to Kiswahili for their ease of understanding.

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Appendix 1: Authorisation letter by NaMATA

NAIROBI METROPOLITAN AREA TRANSPORT AUTHORITY

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NAIROBI, Kenya
Phone: +254 (0) 20 2734886

Ref: NaMATA/C/ADM/2 VOL. IV   2nd March 2023

TO WHOM IT MAY CONCERN

**RE: E-LEARNING FOR BRT DRIVERS: AUTHORIZATION FOR DATA
COLLECTION**

Nairobi Metropolitan Area Transport Authority (NaMATA) was established by an Executive
Order through Legal Notice No.18 of 2017. The mandate of NaMATA is to oversee the
establishment of an integrated, efficient, effective, and sustainable public transport system
within the Nairobi Metropolitan Area (NMA).

NaMATA has commenced implementation of a formal mass rapid transportation system in
the Nairobi. Construction of BRT Line 2, running along Thika Superhighway has commenced
while designs for Clean BRT Core Line 3 are finalised and implementation phase is awaiting
financing agreement. BRT Line 5 is at design stage. It has therefore become necessary to
develop required skills for public transport operations.

The bearer, Eng. Njeri Mburu, a Transport Planner/Road Safety Engineer, is undertaking a
study involving design of an online training module for BRT drivers as part of her Master of
Transportation Sciences Degree at Hasselt University in Belgium. The course will target
paratransit/matatu drivers, aimed at imparting the necessary skills for safe and competent Bus
Rapid Transit (BRT) driving.

To inform the online training module, the study will involve collection of data from SACCO
officials, matatu drivers and public transport sector practitioners, with a view to design an
effective e-learning course for BRT operations in the Nairobi Metropolitan Area. The data
collection will be carried out from **1st March to 30th May 2023.**

The purpose of this letter is to introduce Eng. Njeri Mburu to you, and to inform you that she
will contact you seeking to discuss and collect information from you on the online learning

for BRT drivers. We request you to accord Njeri the necessary assistance and support, as she
carries out this important study.

Any further clarifications or inquiries may be directed to the undersigned.

Eng. Francis Gitau
Ag. **DIRECTOR GENERAL**

Appendix 2: Interview Schedule for SACCO/Company Officials

Development of an E-learning Course for Paratransit (Matatu) and BRT drivers in the Nairobi Metropolitan Area, Kenya

Questionnaire for SACCO Officials

- **This research is for academic purposes only.**
- **You are requested to answer the questions as honestly as possible**
- **Your responses will be treated with confidentiality.**
- **You are not required to write your name anywhere.**

Thank you

1. What is your gender?   Male (   )   Female (   )

2. What is the name of your SACCO? ....

3. What is your position in the SACCO? ……………………………………………………………..

4. Which route/s do your SACCO vehicles ply?
   ……
   ……
   ……

5. What sizes of vehicles are in your SACCO?

   ……
   ……

6. How many drivers are employed in the SACCO? …………………………………………………

7. How many are in each gender? Male (   )   Female (   )

8. What is the minimum level of formal education for a driver?
   ……
   ……
   ………..

9. What class of driving license should the drivers in your SACCO hold?

....
....
....

10. How many years of driving experience should a driver have to qualify for employment in your SACCO?

....
....
....

11. Do you provide continuous training for your drivers? For example, road safety, defensive driving, vehicle maintenance, etc.

....
....
....

12. How many times in a year is each driver trained?

....
....

13. Have you tried online training courses? Yes   (   ) No   (   )
    If "yes," list the title of the course/s below.

....
....
....

14. Do you provide free Wi-fi in your vehicles? Yes   (   ) No   (   )

....

15. We are designing online training for Matatu and future BRT drivers in the Nairobi Metropolitan Area. In your opinion, which are the training needs for your drivers?

....
....

16. Do you foresee any challenges in the implementation of the online training?...

……
………

17. Do your drivers have some free time during the day that they can use to undertake online training?

……
……
……
………

18. What will make the training interesting and captivating for the drivers?

……
……
……
……

19. In your opinion, what will motivate your drivers to complete the training?………
……
……

20. What do you think will encourage your drivers to practice what they learn?

……
……
……

21. Do you have any questions, comments, or something you would like to be included/considered in the online training?

……
……
……

Thank you for your time and effort in taking this interview.

Asante sana.

Appendix 3: Questionnaire for Matatu/Bus Drivers

Development of an E-learning course for Matatu and Bus Rapid Transit (BRT) drivers in the Nairobi Metropolitan Area, Kenya

Questionnaire for Paratransit (Matatu) drivers

- **This research is for academic purposes only.**
- **You are requested to answer the questions as honestly as possible.**
- **Your responses will be treated with confidentiality.**
- **You are not required to write your name anywhere.**
- **Please tick the appropriate box corresponding to your preferred answer or provide information in the space provided.**

Thank you.

1. Please indicate your gender.

   Male ( )   Female ( )

2. Indicate your age group.

20-29 years	( )
30-39 years	( )
40-49 years	( )
Above 50 years	( )

3. What is your level of education?

Primary Level Certificate	( )
Secondary School Certificate	( )
University Degree	( )
College Diploma	( )
TVET (Certificate)	( )

   Other, specify……………………………………………….

4. Indicate your Driving License class

Class D1	( )
Class D2	( )
Class D 3	( )

Class E   (   )

Other, specify……………………………..

5. How long have you driven Public Service Vehicles(PSV)/Matatus?
    Less than one year   (   )

    1-2 years   (   )

    2-4years   (   )

    4-6 years   (   )

    6-8 years   (   )

    Over 8 years   (   )

6. Which SACCO are you currently working for?
    …………………………………………………………..SACCO

7. Which route/s do you most frequently serve?
    ………..
    ………
    ………
    ……

8. What size of vehicle have you been driving?
    14 seater Matatu   (   )

    18 seater Matatu   (   )

    25-seater bus   (   )

    35-seater bus   (   )

    52-seater bus   (   )

    56-seater bus   (   )

    Other, please specify……………………………………………………

9. Have you heard about Bus Rapid Transit (BRT)? Yes (   ) No (   )
    If (No), go to Q. 10

    If (Yes), What do you know about BRT?

....
....
....

10. Would you be interested in training about BRT driving?
    Yes (   ) No (   ) I don't know (   )

11. Have you taken any online training previously?
    Yes   (   ) No   (   )
    If your answer is "No," skip to Q.14

12. If "yes," did you complete the training?
    Yes   (   ) No   (   )

13. If "No," what was the reason for not completing the online training?
    - I did not find the course interesting (   )
    - Inadequate time to study   (   )
    - I did not find the course useful   (   )
    - Poor Internet access   (   )
    - Other, please specify………………………………………………………

14. How do you access the internet?
    - Buy data bundles   (   )
    - Free Wi-fi on the bus (   )
    - Dedicated line at home (   )
    - Other, please specify…………………………………………

15. Are you satisfied with your internet access at the moment?
Very Satisfied [   ] Satisfied [   ] Neutral [   ] Dissatisfied [   ] Very Dissatisfied [   ]

16. What type of phone do you have currently?
    Smartphone (   )   Non-smart phone (   )   Other, specify……………………………………

17. When do you have some free time which you can use to train through your phone?
    - Off-peak during the day   (   )

- In the evening after work   (   )
- At the stage, while waiting for passengers   (   )
- Other, please specify……………………………………….

18. How do you usually spend your free time during a working day?
- Take a nap   (   )
- Other business activities   (   )
- Catching up on social media platforms (   )
- Read a newspaper   (   )
- Chatting with friends   (   )

Other, please specify……………………………………..

19. Identify any training needs that you may require.
- Road safety   (   )
- Emergency response   (   )
- Customer service   (   )
- Gender and Inclusion (   )
- Vehicle maintenance   (   )
- Others, please specify………………………………………….

20. Do you foresee any challenges with the online training?
- Internet access   (   )
- Inadequate training time   (   )
- Difficulties using the phone   (   )
- Not interested   (   )
- Language   (   )
- Other, please specify………………………………………………….

21. What will make the training interesting for you? (Choose one answer)
- Training is useful for my work   (   )
- Interesting videos   (   )
- Use of cartoons   (   )
- Other, please specify……………………………………………………

22. On a scale of 1 to 10 (1 being the least preferred and 10 being the most preferred), what will motivate you to complete the training?

Certificate upon completion   (   )
Promotion upon completion   (   )
Salary increment   (   )
Recognition   (   )
Improve safety record   (   )

23. On a scale of 1 to 10, (1 being the least preferred and 10 being the most preferred), what will encourage you to practice what you learn?

Improved Safety record   (   )
Increased Km covered   (   )
Improved customer feedback   (   )
Better fuel efficiency (   )
Emergency response   (   )
BRT driving license   (   )

24. Do you have any other comment, suggestion, or something you would like to be added to the online training for public transport drivers? Please write your answer below.

……
……
……
……

Thank you for your time and effort in taking this survey.

Asante sana.