
Original Paper

Requirements for Building a Safe Driving Mobile Learning Environment for Positive Behavioral Change of Boda-Boda Riders in Uganda

Paul Birevu Muyinda¹, Godfrey Mayende², Anthony Tibaingana², Patrick Lugenwa², Priscilla Asimire², Lillian Mbabazi², Eva Mirembe², Shallon Atukunda², Innocent Tuhirwe², Richard Kajumbula² & Nazarius Turyakira², Judith Winnie Nzala², Joseph KB Matovu², Ronald Amanyire³

¹ Makerere University, Corresponding author, mpbirevu2013@gmail.com; paul.birevu@mak.ac.ug

² Makerere University, Co-authors.

³ Ministry of Works and Transport, Uganda, Co-authors

Abstract

Commercial motorcycling industry also commonly known as *Boda-Boda* industry has become a major source of livelihood for most of the unemployed youth in Uganda. The industry, however, is chaotic, unprofessional, unregulated and a public health challenge. In a bid to organize, regulate and make the industry safer for road users, Government of Uganda has organized occasional road safety campaigns targeted at commercial motorcyclists (also known as *Boda-boda* riders). These campaigns have yielded insignificant results because the cyclists do not give them the attention they deserve. Poor attention and attendance are accorded to the campaigns because the cyclists are always on-the-go looking for the next passenger. The poor uptake of these campaigns can be enhanced if they are packaged and accessed as andragogical 'doorstep' safe driving campaigns. Doorstep safe driving campaigns can be actualized through mobile learning (m-Learning). However, there is lack of knowledge on requirements for building a mobile learning-based safe driving environment for boda-boda riders in Uganda. Using a cross sectional survey employing concurrent mixed method approach, this paper has adduced system, sensitization, training, and content requirements for a safe driving 'doorstep' m-learning campaign and training aimed at inculcating positive behavioral change for safe driving by riders. The campaign should be sustained on riders' smartphones in *Luganda* language using audio and text media. Sensitization messages that are in line with Government's road safety regulations should be coherent, well thought out and broadcast to riders daily. Constructively aligned training modules on road safety, basic mechanics and defensive driving should be hosted on the m-Learning environment for riders to partake of on-the-go. These requirements should be able to support the building of a mobile safe driving learning environment.

Keywords: Behavioural Change, Boda-boda, m-Learning, Safe Driving, Requirements

1. Introduction

A census on motorcycles by Kampala City Council Authority in Uganda revealed that out of every 42,000 motorcycles registered in a month, 37,000 (88%) are used for commercial motorcycling or transporting passengers (Ministry of Works and Transport, 2022). The motorcycles used in this industry are locally referred to as *Boda-Bodas* and the persons driving them are similarly referred to as *Boda-Bodas* or *Boda-Boda* Riders. In Uganda, 60% of the unemployed population are youth (Alfonsi, Bandiera, Bassi, Burgess, Rasul, Sulaiman, & Vitali, 2020). Due to this high level of unemployment, the youth have resorted to commercial motorcycling as a source of livelihood. Indeed, it is estimated that over 70% of male youths aged between 18 and 35 are commercial motorcyclists commonly referred to in Uganda as *Boda-Boda* riders (Wanume et al., 2019).

Whereas this occupation is considered lucrative by the riders, it has been categorized by the World Health Organization as one of the most unsafe occupations and a public health challenge (Hendrie, Lyle

& Cameron, 2021). This challenge has been observed in Uganda and other countries with commercial motorcyclists. The WHO cited in Hendrie et al. (2022), showed that “1.25 million people are killed each year on the world roads with motorcyclists accounting for every one in four accidents globally” (p. 10871).

In Uganda, it is estimated that 29 out of every 100,000 people die every day due to road accidents (Osuret, Namatovu, Biribawa, Balugaba, Zziwa, Muni, ... & Kobusingye, 2021). The 2021 Uganda Annual Traffic Police Report indicates that out of 4,159 people killed on the road, 1,390 were motorcyclists, which forms the highest number of road user groups killed (Ministry of Works and Transport, 2022). This has been attributed to numerous causes, key among them being lack of road usage education and indiscipline on the road.

According to the Ministry of Works and Transport (2022), the commercial motorcycling industry is chaotic and not well regulated. Over 94% of these riders did not have driving licenses, 98% did not have Public Service Vehicle (PSV) licenses and only 15.7% of the riders had all the requirements to operate. The riders are unruly, insensitive to or unaware of traffic rules and are reckless with their lives. The riders were also reported to be accomplices in crime, had poor entrepreneurial skills and were a high-risk group for HIV/AIDS, pneumonia and other respiratory infections. Their general compliance to all road safety rules and regulations was estimated at only 0.9% (Ndagire, Kiwanuka, Paichadze, & Kobusingye, 2019) and at 27.2% in terms of having a valid driving license and wearing protective head gear (Havugimana, Katamba, & Mutekanga, 2020).

Authors such as Wanume et al. (2019), Havugimana et al. (2020), Ministry of Works and Transport (2022) and others have called for a concerted effort for behavior change among riders in as far as observance of road safety rules and regulations is concerned. A key tool to use is the provision of massive sensitization, education, and training of the riders on safe driving. Boda-boda riders are ‘nomadic’ workers. Therefore, any effort to sensitize or train them must align with the nature of their work.

Boda-boda riders move from one location to another in the day or night as they transport their passengers. They wait for their passengers in temporary parking spaces locally referred to as *Boda-Boda Stages*. When no passengers are available, they will camp at those parking spaces and engage themselves in all sorts of conversations and arguments, many of which could be categorized as, ‘idle talk’. They can also loiter around searching for the next customer.

Measures to curb road carnage in Uganda include providing safe sidewalks, road overpasses, traffic calming mechanisms, road safety campaigns, police enforcement, and road safety educational program (Osuret et al., 2021). The Government of Uganda has organized several road safety education programmes. For instance, in the 2022 Road Safety Week, focus was put on *Boda-boda* safety in the National Road Safety Awareness Campaign. These one-off road safety programmes have been organized at designated places requiring motorcyclists to leave their stages to come and attend to them. This arrangement has not enabled the majority of riders to embrace and attend the campaigns. Riders are not patient enough to congregate and stay in a four-wall classroom environment for more than one hour when they are not earning (Bradbury & Quimby, 2008). Bit-sized (minute) flexible learning approaches enabling them to learn on-the-go as they earn are preferred. This preferred mode of learning for riders has not been designed because there is lack of knowledge on requirements for building a mobile learning-based safe driving campaign for boda-boda riders in Uganda.

This paper dwells on providing andragogic requirements for designing a mobile learning (m-Learning) environment aimed at positively changing the behavior of *Boda-boda* riders in Uganda on safe driving. If *Boda-boda* riders are to be trained on safe driving, the training should be packaged to suit their work life needs. This calls for ‘nomadic life-long learning’ solutions on safe driving. Mobile learning (m-Learning) has andragogical affordances for nomadic life-long learning. A positive behavioral change could be attained if riders are sensitized and trained on-the-go on in safe driving (Hartin, Nugent, McClean, Cleland, Tschanz, Clark, & Norton, 2016). To establish the requirements for the on-the-go sensitization and training curriculum for safe driving, which is the main goal of this paper, answers are provided on the following two research questions: What knowledge, skills and values are needed by riders to develop a positive safe driving behavior? How should the content for sensitizing

and training boda-boda riders be packed for delivery on their mobile phones? To answer these questions, this paper provides the context of safe driving in the introduction, a review of related literature, methods and materials used, findings, the discussion with adduced requirements, conclusion, and recommendations.

2. Mobile Learning and Behavioural Change for Safe Driving

2.1 Mobile Learning (m-Learning)

Mobile Learning (m-Learning) is a form of e-learning which takes place at any time in any places with support from ubiquitous devices such as mobile phones, tabulates, iPads and the like (Traxler, 2009). Mobile learning is presently happening in formal and non-formal learning settings. M-Learning is necessitated by the need to learn or train in non-tethered environments. It is also applicable in situations where the most accessible digital learning devices are mobile devices. It has however been argued that mobile learning definitions should not necessarily be tagged to the use of mobile devices but to the ability of the learner to learn wherever they are.

At its birth m-learning was mainly used for non-formal and informal learning. However, in recent times mobile learning is taking center stage in formal education. Learners in formal education settings are employing mobile devices to access their institution's learning management systems to engage in accomplishing learning activities, participate in collaborative learning, access learning resources and taking formative and summative assessments. A comprehensive evaluation of blended learning at Makerere University revealed that about 70% of the learners who participated in emergency remote learning during COVID-19 lockdown period did so using smartphones (Mugisha & Najjemba, 2022).

Mobile devices use is not only penetrating the education sector but also other sectors. Mobile Apps are being developed to provide digital solutions to almost all day-to-day challenges. In education and training we see mobile Apps for teaching, learning and research (Muyinda, Lubega, & Lynch, 2010). In the health sector, there are Apps for health living (Bayer, 2017; Seiterö, Thomas, Löf, & Müssener, 2021). In Agriculture there are m-Learning systems for agriculture extension services (Sanga, Mlozi, Haug, & Tumbo, 2016; Vikrant, Sayyad, Kumar, Vengatesan, & Singhal, 2020). In the transport sector, there are ride hailing Apps for companies like Safe Boda, Uber, Taxify, and many others (Lim, Yeo, Goh, & Gan, 2018; Chalermpong, Kato, Thaitakul, Ratanawaraha, Fillone, Hoang-Tung, & Jittrapirom, 2023). There is limited evidence on m-learning application for extending road safety education to commercial motorcyclists.

In Uganda, the transport sector has a challenge requiring behavior change of Boda-boda riders for road safety. The challenge requires a training and sensitization solution that can reach the riders wherever they are. Such a solution should be designed as a mobile learning app. With this solution, rider can be trained and sensitized from anywhere at any time. Knowledge of requirements of achieving this solution are lacking, making this paper a necessity.

2.2 Behavioral Change for Safe Driving

The *Boda-boda* transport mode in Uganda is reported to be the most unsafe for its passengers. Boda-boda transport accidents contributes about 33.4 % of the accidents on Ugandan roads (Ministry of Works and Transport, 2022). Police has attributed this state of affair to riders who are impatient; lack driving permits, ethics and ethos; lack of respect for other road users and the lust for 'quick money'. All this portray negative behavior that need concerted effort to change. Concerted efforts in sensitizing and training *Boda-boda* riders for positive behavioral change are called for (Ministry of Works and Transport, 2022; Osuret et al., 2021).

Behavior entails "anything a person does in response to internal or external events" (Davis, Campbell, Hildon, Hobbs, & Michie, 2015, p.327). Therefore, behavior change is a change in one's observable and non-observable actions. In Davis et al. (2015, p. 333), 82 theories are identified as theories that underpin behavior and behavior change. Whereas we looked at each of these theories, we do not have space in this paper to talk about each and every theory. We decided to adopt the Transtheoretical Model of Behaviour Change (Prochaska & Di Clemente, 1982) because it provides us with the necessary steps to follow to enhance behavior change among Boda-boda riders in Uganda.

The Transtheoretical Model of Behaviour Change provides for five sequential stages of behavior change (Prochaska & Di Clemente, 1982). The stages in order of sequence are i) Precontemplation; ii) Contemplation; iii) Preparation; iv) Action; and v) Maintenance. In the *Precontemplation* stage, there is no intention to change. Here no intervention has been put in place to have the desired change in an individual. In this stage, the individual is in the undesired behavior situation. In the *Contemplation* stage, some intervention aimed at having an individual change can be put in place. Such an intervention could be sensitization about the value or pros of moving to the desired behavior. This stage leaves the individual contemplating whether to join the initiative of being prepared for the desired change or not. In the *Preparation* stage, the individual is facilitated to change. For instance, the individual joins training sessions or participates in practicums to prepare him/her for the desired change. Once the individual is prepared, they may start practicing what they have learned, hence the *Action* stage. If the individual finds that the advantages of putting into practice what they have learned outweigh the disadvantages, then the individual progresses into the *Maintenance* stage, where he/she perpetuates the new behavior (ibid).

An individual for whom behavior change is desired should systematically be taken through these five stages. This theory has been applied in persuasive interventions (Bayer, 2017). Transtheoretical Model of Behavior Change uses a persuasive approach and hence is a carrot approach to behavior change. The present level of confusion in the Boda-boda industry demand this 'carrot' approaches if any grain of behavior change is to be realized.

In this paper, we consider the *Contemplation* and *Preparation* stages as the most critical stages in behavior change. These two stages can best be achieved through sensitization and training. Owing to the nomadic nature of Boda-boda riders, mobile learning (m-Learning) comes in hand as the most appropriate sensitization and training tool. The m-learning curriculum for preparing riders for behavioral change in road safety should contain knowledge and skills on road safety aspects.

According to the Uganda Road Safety Act, 1998, cited in Ministry of Works and Transport (2022), the riders need to be knowledgeable about and skillful on observing traffic laws and signals. They need to wear requisite gears like helmets, riding jackets (padding) and reflector jackets. They need to desist from any driving distractors such as talking on phone, drinking, or eating while driving. They should not drive on shoulders to ensure a safe reaction time in case of abrupt stops or turns of vehicles ahead of them. They should always be sober while driving – should not drive under the influence of alcohol or medicines with a drowsy effect. They should avoid haggling for customers, zigzagging in the road or abruptly changing lanes. The motorcycle should be kept in excellent mechanical conditions by regularly undertaking preventive maintenance. Positive behavioral change for road safety can be attained if riders are regularly trained on these road safety tenets.

2.3 Mobile Learning and Behavioural Change for Safe Driving

Education has been fronted as the number one tool for behavior change. People act and behave in a certain way because they are not enlightened on the other alternative. What knowledge, skills and ethos can be peer transmitted through mobile devices to continuously reach Boda-boda riders wherever they are. Mobile Apps are increasingly being developed for training different individuals in different aspects of behavioral change. In Bayer (2017) m-Learning is reported to have been effectively used to curtail lifestyle diseases using text messages authored by peers to motivate users to enhance their levels of physical activity. Peers author and share messages within physical activity groups to encourage each other to do physical exercise. As such the m-learning could be used to cause behavioral change among riders.

2.4 Andragogy

Andragogy is the art and science of helping adults learn (Davenport, 1987). Boda-boda riders are adults above the age of 18. The goal of adult learning should be self-actualization (Knowles, 1980). Thus, the adult learning process should involve the whole emotional, psychological, and intellectual being of a learner. The mission of adult learners is to assist them to develop their full potential, and andragogy is the teaching methodology used to achieve this end. In andragogy, the teacher is a facilitator who aids adults to become self-directed learners. Boda-boda riders cannot attend orchestrated classroom training but ought to train themselves in safe driving. The m-learning environment must therefore take into consideration andragogical principles.

3. Methods and Materials

This paper reports on andragogic requirements for building a m-Learning environment for safe driving for boda-boda riders. A cross-sectional survey employing concurrent mixed method approach was adopted. The population (N) consisted of Boda-boda riders. The sample size was determined using Krejcie and Morgan (1970) sample size determination table. According to Wanume et al. (2019), there are over 500,000 (N) youth in the Boda-boda industry in Uganda. This translated into a sample size (n) of 384. This sample was selected using multi-stage sampling method involving cluster sampling at Stage One, convenient sampling at Stage Two and simple random sampling at Stage Three. The Four regions of the country (East, West, North and Central) formed the clusters (Stage One). Two regions (East and Central) were selected from the four regions using convenient sampling (Stage 2). From each of the two selected regions, 192 Boda-boda riders were selected using simple random sampling (Stage 3).

Data was collected using a research assistant administered questionnaire. The use of research assistants was preferred because majority of the respondents were not in position to fill the questionnaire by themselves. At the end of the survey 281 (the new N) filling questionnaires were returned.

To ensure reliability and validity of research instrument as a requirement for data validation, a pre-test/pilot of the data collection tool was done. Reasonable care was taken during this process to ensure that ambiguity of questions and instructions are eliminated. The data collected was processed by editing it to check for accuracy. Open ended questions were coded before analysis. Quantitative data was captured using EPIINFO® Software and then exported to SPSS for data analysis, where descriptive and inferential statistics were generated. Qualitative data was transcribed verbatim and analysed using Atlas ti. This resulted into requirements for building a m-Learning environment for positive behavioural change of Boda-boda riders for safe driving.

4. Findings

The goal of the research was to establish requirements for building a m-Learning environment for positive behavioural change of Boda-boda riders for safe driving. The requirements were adduced from findings on the general characteristics of Boda-boda riders, their mobile technology ownership and use profile, challenges they faced while using mobile phones and their safe driving knowledge attitudes and practices. These requirements provide a foundation for building a robust safe driving m-learning environment for boda-boda riders.

4.1 General Characteristics Boda-boda Riders in Uganda

4.1.1 Age Distribution

To determine the most prevalent age group employed in the Boda-boda riding industry, the age distribution of respondents was picked. Results are presented in Table 1 below.

Table 1. Age distribution of respondents

Age	Freq	%age
Below 18	18	6
18 - 25	89	32
26-30	99	35
31 - 35	54	19
36 - 40	13	5
Above 40	8	3
Total	281	100.0

Source: Primary data

The age group 18 to 35, the youth age group, constituted the majority (86%) of respondents. This means that the Boda-boda industry employs mainly youth. Also about 6% of the riders are minors (below 18 years) as per Ugandan Labour laws. This illegality demands for urgent sensitization.

4.1.2 Gender Distribution

The gender dimension of Boda-boda riders was investigated. The aim was to establish the most predominant gender in the Boda-boda industry. The results are presented in *Table 2* below.

Table 2. Gender distribution of respondents

Gender	Freq	%age	Valid %age
Men	276	98.2	99.6
Women	1	0.4	0.4
Non Response	4	1.4	
Total	281	100.0	100

Source: Primary data

The Boda-boda industry in Uganda is a men dominated industry. Almost all (99.6%) riders who participated in the research were men. Boda-boda riding is not attractive to women as was confirmed by the answer to the question why women were not visible in the industry. “Women cannot manage the tough conditions we go through in our job”, said one of the male riders. If Boda-boda riding is to be made a dependable employment avenue for the youth, it must be made safe to attract women as well.

4.1.3 Mobile Phone Ownership

Mobile phone ownership among boda-boda riders was investigated to ascertain if they owned mobile devices. The majority 93.5% of the Boda-boda riders owned mobile phones. Not all phones can conveniently be used for mobile learning. Smart phones are most appropriate enabler of mobile learning. We thus investigated the ownership of smart and ordinary phones. The findings revealed that the majority (82%) of the riders owned ordinary phones while only about 18% owned smart phones.

4.1.4 Motorcycle Ownership

Although economic security is a function of income and asset ownership (Doss, 2010), we were surprised to find that ownership of motorcycles varied vastly across riders. *Table 3* below reveals this.

Table 3. Motorcycle Ownership

Motorcycle Ownership	Freq	%age	Valid %age
It is mine	91	32.4	32.9
I pay owner daily	90	32.0	32.5
On loan	67	23.8	24.2
Part-time hiring from other riders (Kibaluwa)	29	10.3	10.5
Non Response	4	1.4	
Total	281	100.0	100

Source: Primary data, N=281

Only about 33% of the riders interviewed fully owned the motorcycles they were riding. The majority (about 67%) did not have full ownership of motorcycles they were riding. Of the 67% who did not have full control of the motorcycle they rode, 32.5% rented a motorcycle, 24.2% were riding motorcycles loaned to them while 10.5% rode motorcycles lent to them by fellow riders to earn a coin for food (commonly referred to as *Kibaluwa*). *Kibaluwa* was only possible when the main rider was resting and was willing to assist a colleague with no motorcycle earn a subsistence of the day. These characteristics could explain the rush and insensitivity of most riders on the road because they wish to earn substantial income as soon as they hit the road. Education on how to save to acquire a personal motorcycle is necessary.

4.1.5 Languages Spoken

It was important to understand the most common languages spoken by boda-boda riders so as to understand the universal language that could be used for an educational intervention for Boda-boda riders. The riders were asked to state any language they were able to fluently speak. The results are presented in Table 4 below.

Table 4. Languages spoken

Language	Yes		No		Non-Response		Rank
	Freq	%age	Freq	%age	Freq	%age	
English	132	47.0	147	52.3	2	0.7	3
Luganda	235	83.6	44	15.7	2	0.7	1
Runyankole	34	12.1	245	87.2	2	0.7	6
Lusoga	162	57.7	117	41.6	2	0.7	2
Lusamia	91	32.4	188	66.9	2	0.7	4
Kiswahili	38	13.5	241	85.8	2	0.7	5
Luo	9	3.2	270	96.1	2	0.7	8
Others	23	8.2	256	91.1	2	0.7	7

Source: Primary data, N = 281, percentages calculated row-wise

The study was carried out in Central and Eastern parts of Uganda. The findings show that Luganda language was the most widely spoken among Boda-boda riders in Central and Eastern Uganda, followed by Lusoga. English came in the third position. Other languages in order of popularity were Lusamia, Kiswahili, Runyakole, Luo, Ateso, Rutooro, Rukonjo and Rulundi. An m-Learning App for Boda-boda riders expressed in Luganda will be much more comprehended than one expressed in other languages.

4.1.6 Literacy Levels of Boda-boda Riders

We defined literacy as ability to read and write in one's preferred language. Therefore, respondents were asked to indicate whether they could read and write in any language. The findings show that over 80% of the respondents could read and write as seen in Table 5 below.

Table 5. Boda-boda riders' literacy levels

Ability to read and write (Literacy)	Freq	%age	Valid %age
Yes	223	79.4	80.5
No	54	19.2	19.5
Non-Response	4	1.4	
Total	281	100.0	100

Source: Primary data; N=281

The majority (80.5%) of Boda-boda riders are literate. They can read and write in their preferred languages. We were able to establish the languages they could read and write and the extent to which they could read and write such languages respectively. The results are presented in Tables 6, 7, 8 and 9 below.

Table 6. Ability to read different languages

Language	Yes		No		Non-Response		Rank
	Freq	%age	Freq	%age	Freq	%age	
English	130	58.3	89	39.9	4	1.8	2
Luganda	172	77.1	47	21.1	4	1.8	1
Runyankole	29	13.0	190	85.2	4	1.8	5
Lusoga	77	34.5	142	63.7	4	1.8	3
Lusamia	31	13.9	188	84.3	4	1.8	4
Kiswahili	20	9.0	199	89.2	4	1.8	6
Luo	-	-	219	98.2	4	1.8	8
Others	6	2.7	213	95.5	4	1.8	7

Source: Primary data, N=223, percentages are calculated row-wise

Of those who are literate (N=223), they are more comfortable with reading the Luganda language (77.1%) than any other languages. Nonetheless, English, the official language in Uganda, is the second most language (58.3%) that Boda-boda riders can be able to read. Thus, an m-Learning environment targeted at providing learning to Boda-boda riders should be best expressed in the Luganda language.

To fully grasp their reading ability, we asked them to rate their reading of the most widely used languages (Luganda). The findings show that about 43% were good at reading. However, only a small percentage of about 10.8% could read excellently. It is worth noting that we did not do the testing and we are reporting on perceptions.

Table 7. Extent of reading in most convenient language

Extent of reading in most convenient language	Freq	%age	Valid %age
Fair	54	24.2	24.7
Good	96	43.0	43.8
Very Good	45	20.2	20.5
Excellent	24	10.8	11.0
Non Response	4	1.8	
Total	223	100.0	100

Source: Primary data, N= 223

The extent of reading the most widely read language (Luganda) is fair at 24.2%, good at 43.0, very good at 20.2 and excellent at 10.8% as seen in Table 7 above. Where text will have to be used in the m-learning environment, simple Luganda language should be used to enable all riders to read the textual content with ease. The ability of the riders to write their most widely used language is further investigated in Table 8 and 9 below.

Table 8. Ability to write different languages

Language	Yes		No		Non-Response		Rank
	Freq	%age	Freq	%age	Freq	%age	
English	130	58.3	86	38.6	7	3.1	2
Luganda	163	73.1	53	23.8	7	3.1	1
Runyankole	27	12.1	189	84.8	7	3.1	4
Lusoga	59	26.5	157	70.4	7	3.1	3
Lusamia	23	10.3	193	86.5	7	3.1	5
Kiswahili	17	7.6	199	89.2	7	3.1	6
Luo	1	0.4	215	96.4	7	3.1	8
Others	4	1.8	212	95.1	7	3.1	7

Source: Primary data, N=223 (can read and write), percentages are calculated row-wise

As seen in Table 8 above, the majority (73.1%) of Boda-boda riders can write Luganda followed by English (58.3%) then Lusoga (26.5%). Since learning is a two-way process, learners require to give feedback. Where learners are required to provide textual feedback, it ought to be done in Luganda (a language they can easily write). The extent of writing this language is given in Table 9 below.

Table 9. Extent of writing in most convenient language

Extent of writing in most convenient language	Freq	%age	Valid %age
Fair	55	24.7	25.6
Good	92	41.3	42.8
Very Good	45	20.2	20.9
Excellent	23	10.3	10.7
Non Response	8	3.6	
Total	223	100.0	100

Source: Primary data, N= 223 (can read and write)

The extent of writing the Luganda language is fair at 25.6%, good at 42.8%, very good at 20.9% and excellent at 10.7% as is seen in Table 9 above. Where text will have to be used in the m-learning environment for providing feedback, riders should be free to write in Luganda.

4.2 Boda-Boda Riders Technology Profile

Most riders (93.5%) owned mobile phones, 82% of which were of the ordinary type and 18% were of smart type. Airtel (92%), MTN (68%) and Africell Uganda (6%) were the subscribed to mobile network provider. Riders used their mobile phones for placing and receiving calls (98%) and SMS messages (65%) and listening to radio (54%). Only 19% used their mobile phones for education or learning purposes. Internet surfing, receiving mails and watching television were the other uses for mobile phones. Only 7% used Internet on their phones to conduct their riding business. Those who were using Internet for riding business were subscribers of Safe Boda (69%). WhatsApp was subscribed to by 31% of the riders. Audio and text media is commonly used.

4.3 Challenges Boda-Boda Riders Experience While Using Mobile Phones

Since our interest was to cause a positive behavioral change amongst Boda-boda riders using m-Learning, it was worthwhile investigating the challenges riders face while using mobile phones generally. This was critical for our study because then we could be able to provide solutions during the behavioral change training. The challenge reported, included inability to text while riding, power outages, high costs of airtime and data, slow internet speed, lack of internet in many areas they operated in, among others.

The findings of this section clearly demonstrated that Boda-boda riders owned mobile phones. This was in line with the increasing national coverage of mobile phone network and increasing ownership of mobile telephony in the World. As such, an m-Learning intervention would not face resistance since the target audience was already exposed to mobile phone usage.

4.4 Boda-boda Riders and Safe Driving

Business efficacy requires safety of the producer and consumer. This is even more critical in services where we buy experience and not physical products. Hence, consumers of Boda-boda services need to be safe as they experience the services purchased. In this study, Boda-boda riders were engaged on the issue of safe driving to find out their level of knowledge, skill and ethos when driving. Effort was also made to find out their willingness and readiness to learn.

4.4.1 Riding Experience

It is always argued that experience is the best teacher. Respondents were asked to state the period they had been riding to establish their level of experience. Table 10 below shows the riding experience.

Table 10. Respondents riding experience

Years of riding experience	Frequency	%age	Valid %age
0-5 years	177	63.0	63
6-10 years	69	24.6	25
10+ years	33	11.7	12
Non-response	2	0.7	
Total	281	100.0	100

Source: Primary data, N=281

Majority of the boda-boda riders (63%) reported having experience of less than five years, an indicator that most motorcycle riders are not experienced riders. The dearth of riding experience is a big contributor to the ever-increasing boda-boda related road accidents involving Boda-boda riders.

4.4.2 Age at First Riding

Age is used to determine maturity of a person. Some age is considered young, adult or elderly. Riders were asked at what age they first rode a motorcycle. Table 11 presents the findings.

Table 11. Respondents' age at first riding

Age at first riding	Frequency	%age	Valid %age
Below 18 years	19	6.8	6.8
18-30 years	236	84.0	84.6
30+ years	24	8.5	8.6
Non-response	2	0.7	
Total	281	100.0	100

Source: Primary data, N=281

Majority of the riders (84%) said that they were 18 years and above at first riding, and 6.8% mentioned having started riding when they were below 18 years of age.

4.4.3 Possession of Driving Permit

It is a legal requirement for every driver to train and be issued with a valid driving permit before he/she engages in boda-boda business. What we established in *Table 12* below is contrary to this basic road safety requirement.

Table 12. Riders' possession of a driving permit

Possession of driving/riding permit	Frequency	%age	Valid %age
Yes	35	12	13
No	244	87	87
Non-response	2	1	
Total	281	100	100

Source: Primary data, N=281

The study revealed that most boda-boda riders (87%) had never trained and acquired a driving permit for motorcycles. This collaborates with the earlier findings which indicated that 6.8% of the riders had started riding before the legal age of 18.

4.4.4 Year when the Driving Permit was Acquired

Riders with a driving permit (13%) were asked to state the year when they acquired them. This was done to collaborate it with the driving experience of the riders in Table 13 *below*.

Table 13. Year when riders acquired permit

Year when permit was acquired	Frequency	% age	Valid % age
1999	1	3	3.6
2006	2	5	7.1
2009	2	5	7.1
2011	1	3	3.6
2014	1	3	3.6
2015	2	5	7.1
2016	1	3	3.6
2017	4	11	14.3
2018	6	16	21.4
2019	8	22	28.6
Non-response	9	24	
Total	37	100	100.0

Source: Primary data, N=281

This study was conducted in January and February of 2019. Riders with riding experience of between 0 to 5 years (2014 -2019) constituted the majority at a cumulative 78.6%. Only 21.4% of the riders had a driving experience of more than 5 years. Having a big pool of riders with no driving permits (87%) and less experienced riders (78.6%) might be one of the leading causes of indiscipline and ever-rising road accidents involving Boda-boda riders. This calls for a massive programme to train and retrain the riders.

4.4.5 Reasons for Driving without a Driving Permit

To understand their behavior, riders were asked to state the reasons why they rode without a permit. The reasons given included among others; expense involved in processing a permit (75%), ability to freely ride without a permit (34%) demonstrating a weakness in law enforcement, not knowing the procedure of getting a permit (43%) and inability to find resource necessary to process the permit (66%) at the time they started riding. Others argued that they had no time to process a permit (10%), they had no required documentation like national identity card (20%), etc. It should be noted that these reasons are majorly behavioral oriented. These should be addressed in the training and sensitization curriculum for safe driving.

Despite the various reasons advanced for not having driving permits, about 90% of boda-boda riders claimed to know the rules governing the road usage. This contradicts the fact that about 87% did not possess riding permit, a fact that call for a further investigation. It is also a clear manifestation that rules are known but often faulted perhaps because of weak enforcement. The training curriculum should emphasize the need to observe road safety regulations.

4.4.6 Rationale for Wearing a Helmet

Some of the rules compel boda-boda rider to wear a head helmet while riding. Wearing a helmet is one of the important safety measures when riding on a motorcycle. Indeed, majority (over 94%) of the riders trust that wearing the helmet is mostly useful for the protection of the head against injuries in case of an accident. For example, 80% believe that the helmet protects their head from moving objects and insects, about 75% argued that the helmet protects their eyes from dust while riding, while others (about 25%) used the helmet because of police enforcement. Consequently, majority (over 88%) were willing to carry a passenger without wearing a helmet. This is against the rules and regulations governing the boda-boda riders but going against it indicates a huge extent of lack of safety for the passengers.

4.4.7 Reasons for Carrying a Passenger without Wearing a Helmet

Since a helmet is considered a safety precaution, it was of interest to find out why boda-boda riders faulted this safety rule and exposed their passengers to the road risk. The findings showed that there were various reasons why riders carried passengers without wearing helmets. Some of the reasons were rider related while other were passenger related. Of all reasons advanced, the findings showed that 87.2% of the rider's lacked an extra helmet to give to the passenger. Moreover, a significant percentage (69%), knew it was compulsory for passengers to wear helmets. From the passenger point of view, about 38% did not want to wear the helmet. Of these 17% considered wearing passenger helmet as unhealthy. This means that majority of the passengers are willing to wear helmets but cannot find them with the riders. Rider education on helmet usage becomes necessary.

4.4.8 Involvement in an Accident

Riders were asked about whether they had ever been involved in an accident. Most of the riders (71%) consented to having ever been involved in a road accident. This is a significant proportion which explicates the fear observed among passengers on the use of boda-boda transport.

4.4.9 Causes of Accident among Boda-boda Riders

The riders attributed accidents to several factors as listed and ranked in Table 14 below.

Table 14. Causes of boda-boda accidents

Causes of accidents	Percentage	Rank
Crossing animals	43.5%	1
Poor road condition	42%	2
Over speeding	41.5%	3
Other motorists/ Boda-boda	30.5%	4
Poor mechanical condition motorcycle	21.5%	5
Struggling for a passenger with other Boda-boda riders	16%	6
Over loading	15.5%	7
Excitement during celebrations	11%	8
Drink riding/driving	8.5%	9
Others (Faulty lighting system; crossing the road badly)	6.5%	10

Source: Primary data, N=281

The most prevalent causes of accidents emanated from animals abruptly crossing the roads (43.5%), poor road conditions (42.0%) and over speeding (41.5%). An m-Learning curriculum on safe driving should include lessons on the highlighted causes of accidents in Table 14 above.

4.4.10 Ways of Avoiding Accidents

Due to the high accident prevalence rate, Boda-boda riders were asked to provide solutions for reducing accidents on the road. Given that there were various causes, so were the possible solutions suggested. The solutions included being extra careful on the road 57%, observing speed limits 53%, government ensuring good road conditions 46.5%, undertaking professional riding 23.5%, ensuring that the Boda-boda is in good mechanical conditions 24%, avoiding unnecessary excitement 21.5%, avoiding drink riding 19% and avoiding over loading 23%, among others. These aspects ought to be included in the training curriculum for riders.

It was further observed that although undertaking professional riding is correlated with reduced accidents because it feeds into knowing road signs and rules, in this study, the riders did not give it much consideration. This is a sign that more behavioral change learning is needed which will address such thinking. This made us interrogate the training aspect further as is described in the section that follows.

4.4.11 Training on Riding

Training on driving/ riding is important in ensuring safety. The findings of the study showed that the majority (66%) of the boda-boda riders reported to have learnt riding through friends or family members. On the job training (self-training) where riders were learning as they rode accounted for 31% and very few, about 3%, went to driving schools. Such training from friends or family was not enough to ensure safe driving. The training curriculum ought to be developed by experts in road safety. Similarly, the training itself out to be done by professional trainers to minimize risks of inadequate training.

Riders were asked to mention the training they had ever undertaken. Results are presented in Figure 1 below.

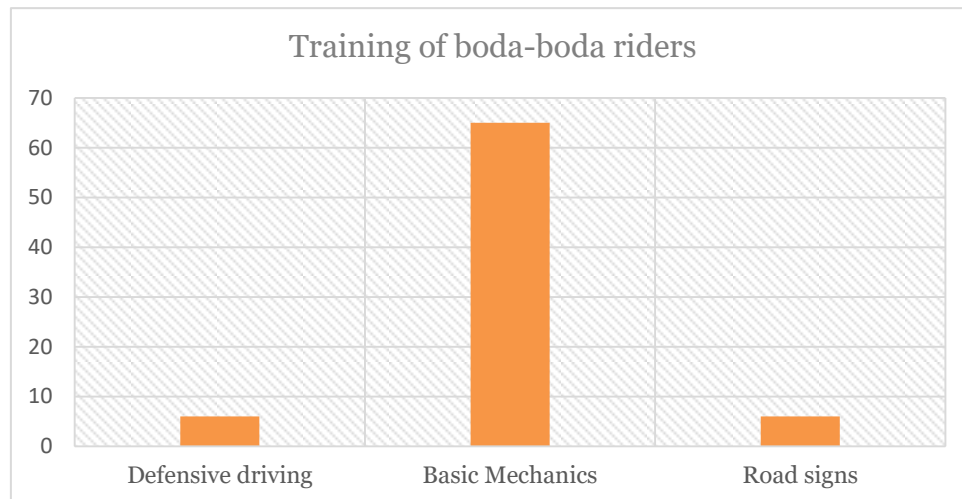


Figure 1. Training of boda-boda riders

Source: Primary data

Most riders 65% indicated they had been trained in basic mechanics of Boda-boda. About 5% had trained in defensive driving and reading of road signs. This indicates that the majority of riders are more interested in the Boda-boda repair business than the riding business. It also shows that there was inadequate or no training on Boda-boda safe driving. This suggested the need to have safe driving training for road safety.

4.4.12 Road Safety Sensitization

The study also investigated the aspect of road safety sensitization. The majority of respondents, about

71%, reported having ever been sensitized on road safety. Sensitization on road safety was carried out by individuals and government and non-government organizations. For example, about 58% of the Boda-boda riders reported to have been sensitized by friends/peers/ and fellow riders. Those who reported to have been sensitized by traffic police officers were 52%. About 19% had received such sensitization from schoolteachers and very few 10% had received sensitization from driving school instructors. In addition, some riders received such critical sensitization from other sources, for instance 7% argued they were sensitized by mass media or Safe Boda. There is lack of a coherent and sustained sensitization system. The solution is to have coherent sustained sensitization messages provided to riders through an m-learning system.

4.4.13 Training Needs

With the observed inadequate training in riding and the incoherent sensitization, it became apparent that our goal of organizing the boda-boda industry could not be achieved without additional training. However, this was dependent on the riders' willingness to take on more training. We asked riders about the aspects in which they required additional training. Riders expressed need for training in the areas depicted in Figure 2 below.

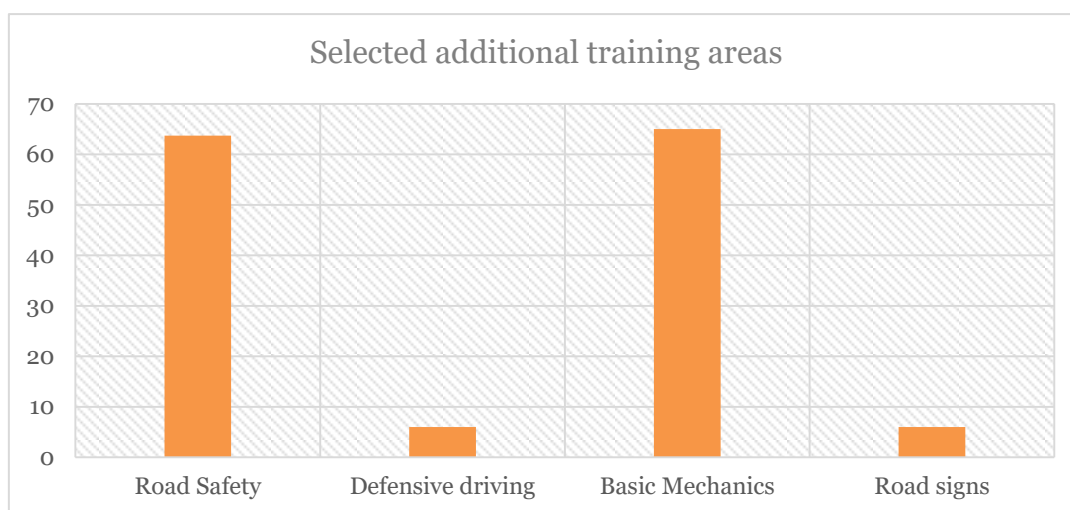


Figure 2. Aspect for more training

Source: Primary data

The majority 66% required training in basic mechanics followed by road safety 65%, defensive driving 5% or road signs reading 5%. For safe driving, the training curriculum should emphasize all aspects of road safety as is stipulated the national Road Safety Act 1998.

5. Discussion

The goal of our study was to establish requirements for an m-learning environment aimed at causing positive behavioural change for safe driving among Boda-boda riders in Uganda. System, sensitisation, training and learning content requirements have been adduced from the findings and here below discussed.

5.1 System Requirements

A study to evaluate the blended learning uptake at Makerere University revealed that 70% of the learners accessed learning resources from the learning management system using their smartphones (Mugisha & Najjemba, 2022). Mobile phone ownership trend among Boda-boda riders is not any different. About 93.5% of boda riders in Uganda own mobile phones. However, only about 18% of these phones are smartphones. Smartphones are the most enabler of m-Learning. Ordinary phones only

have the affordance of placing and receiving calls and text messages. Riders will thus have to be provided with smartphones if they are to conveniently participate in m-learning for safe driving. The language of instruction should be Luganda since majority of riders prefer and can easily express themselves (100%), read (77.1%) and write (77.1%) in this language. The learning objects should be expressed in easily accessible media (audio and text) because it permits riders to listen in and read on-the-go.

5.2 Sensitizations Requirements

Results have indicated that positive behavioral change can be attained if riders are sensitized on safe driving practices while at their workstation using a door-step approach (m-Learning). Through m-Learning, riders can receive coherent and well thought out SMS messages on their mobile phones on safe driving practices. The messages could among others be on: 1) lawful driving age, 2) need to acquire experience before riding on busy roads, 3) the process of acquiring a driving permit; 4) requirements for acquiring a driving permit, 5) benefits of having a driving permit; 6) need to observe road safety regulations; 7) need to wear protective gear while riding, 8) causes of road accidents, 9) avoiding road accidents, 10) need to train with professional trainers and 11) road usage etiquettes. The sensitization curriculum ought to be crafted around these areas. When these messages are repeatedly given in a persuasive way to the riders on their mobile phones, they will contemplate, prepare and take action (Prochaska & Di Clemente, 1982) to positively change their behavior on safe driving. In Bayer (2017) m-Learning is reported to have been effectively used to curtail lifestyle diseases using text messages authored by peers to motivate users to enhance their levels of physical activity. Further, a sensitization solution is in line with Ministry of Works and Transport (2022) and Osuret et al. (2021) solutions for positive behavioral change of riders.

5.3 Training Requirements

For knowledge, skills and values needed in their trade the riders revealed that they needed training in basic mechanics 66%, road safety 65%, defensive driving 5%, and road sign reading 5%. An m-Learning curriculum for safe driving should be designed around these areas. All aspects of road safety as stipulated in the Uganda Road Safety Act, 1998 need to be considered. The riders need to be knowledgeable about and skillful on observing traffic laws and signals. They need to wear requisite gears like helmets, riding jackets (padding) and reflector jackets. They need to desist from any driving distractors such as talking on phone, drinking or eating while driving. They should not drive on shoulders to ensure a safe reaction time in case of abrupt stops or turns of vehicles ahead of them. They should be sober at all times while driving – should not drive under the influence of alcohol or medicines with a drowsy effect. They should avoid haggling for customers, zigzagging in the road or abruptly changing lanes. The motorcycle should be kept in excellent mechanical conditions by regularly undertaking preventive maintenance. Positive behavioral change for road safety can be attained if riders are regularly trained on these road safety tenets (Ministry of Works and Transport, 2022).

5.4 Content Packaging Requirements

m-Learning requires bit-sized learning. Non-SMS based learning content should be granulated into learning objects that can be rendered on smart phones. The content should be well constructively aligned (Biggs, 2003) with clear learning outcomes, learning assessment activities and resources to support the accomplishment of learning activities.

6. Conclusion and Recommendations

6.1 Conclusion

Boda-boda riders in Uganda lack the requisite awareness, knowledge, skills and ethos of safe driving. Sensitization and training initiatives are organized by the Ministry of Works and Transport on a knee jack basis, yet the magnitude of road rage occasioned by Boda-boda riders continues to increase. Tenets of safe driving are not engrained in the behaviors of Boda-boda riders. Concerted, sustained and accessible sensitization and training initiatives are needed to persuade the riders to adopt safe driving behaviors and practices. Such initiatives should permit the riders to learn on-the-go. Learning on the go will accelerate the behavior change needed in the Boda-boda industry.

6.2 Recommendations

The sensitization curriculum should include aspects on lawful driving age, benefits of experienced driving, process of acquiring a driving permit; requirements for acquiring a driving permit, benefits of having a driving permit; observing road safety regulations; wearing protective gear while riding, causes of road accidents, avoiding road accidents, and seeking professional trainers. The training curriculum should be built around road safety, basic mechanics, and defensive driving. Both sensitization and training content should be bit-sized to be accessible on all forms of smart phones.

Acknowledgement

We wish to acknowledge the Government of Uganda for funding the research that culminating into this paper. This research would have not seen the light without the Government's Research and Innovation Fund (RIF). Our heartfelt appreciation goes to the RIF Secretariat at Makerere University for their continued support during the conduct of the research. We also wish to acknowledge all research participants and research assistants and administrators of the Enhancing Behaviour Change of Boda-boda Riders in Uganda Using Mobile Learning (EBOML) Project.

References

- Alfonsi, L., Bandiera, O., Bassi, V., Burgess, R., Rasul, I., Sulaiman, M., & Vitali, A. (2020). Tackling youth unemployment: Evidence from a labor market experiment in Uganda. *Econometrica*, 88(6), 2369-2414.
- Bayer, F. (2017). *Achieving behaviour change: Evaluating the differences in content and motivational value of peer-and expert-written messages in the context of physical activity* (Master's thesis, University of Twente).
- Biggs, J. (2003). Aligning teaching and assessing to course objectives. *Teaching and learning in higher education: New trends and innovations*, 2(4), 13-17.
- Bradbury, A., & Quimby, A. (2008, June). Community road safety education: An international perspective. In *Proceedings of The Institution of Civil Engineers-Municipal Engineer* (Vol. 161, No. 2, pp. 137-143). Thomas Telford Ltd.
- Chalermpong, S., Kato, H., Thaithatkul, P., Ratanawaraha, A., Fillone, A., Hoang-Tung, N., & Jittrapirom, P. (2023). Ride-hailing applications in Southeast Asia: A literature review. *International Journal of Sustainable Transportation*, 17(3), 298-318.
- Davenport, J. (1987, March). A way out of the andragogy morass. *A paper presented at the Conference of the Georgia Adult Education Association*, Savannah, GA.
- Davis, R., Campbell, R., Hildon, Z., Hobbs, L., & Michie, S. (2015). Theories of behaviour and behaviour change across the social and behavioural sciences: a scoping review. *Health psychology review*, 9(3), 323-344.
- Hartin, P. J., Nugent, C. D., McClean, S. I., Cleland, I., Tschanz, J. T., Clark, C. J., & Norton, M. C. (2016). The empowering role of mobile apps in behavior change interventions: the gray matters randomized controlled trial. *JMIR mHealth and uHealth*, 4(3), 48-78
- Havugimana, J. D., Katamba, P., & Mutekanga, D. R. (2020). Influence of motorcycle (Boda Boda) rider's practices on road safety in Kampala, Uganda. *Asian J Sci Technol*, 11(4), 10871-10879.
- Hendrie, D., Lyle, G., & Cameron, M. (2021). Lives saved in low-and middle-income countries by road safety initiatives funded by Bloomberg Philanthropies and implemented by their partners between 2007–2018. *International journal of environmental research and public health*, 18(21), 11185.
- Knowles, M. S. (1980). *The modern practice of adult education*. New York: Cambridge, The Adult Education Company
- Lim, K. B., Yeo, S. F., Goh, M. L., & Gan, J. A. X. (2018). A study on consumer adoption of ride-hailing apps in Malaysia. *Journal of Fundamental and Applied Sciences*, 10(6S), 1132-1142.

Ministry of Works and Transport (2022). Launch of the National Road Safety Week. Accessed on October 25, 2022 from <https://www.works.go.ug/index.php/resources/news-impact/item/106-launch-of-the-national-road-safety-week>

Mugisha, A., & Najjemba, H. (2022). Comprehensive Evaluation of Blended Learning Uptake at Makerere University. Study Report, Unpublished, Makerere University

Muyinda, P. B., Lubega, J. T., & Lynch, K. (2010). Unleashing mobile phones for research supervision support at Makerere University, Uganda: the lessons learned. *International Journal of Innovation and Learning*, 7(1), 14-34.

Ndagire, M., Kiwanuka, S., Paichadze, N., & Kobusingye, O. (2019). Road safety compliance among motorcyclists in Kawempe Division, Kampala, Uganda: a cross-sectional study. *International journal of injury control and safety promotion*, 26(3), 315-321.

Osuret, J., Namatovu, S., Biribawa, C., Balugaba, B. E., Zziwa, E. B., Muni, K., ... & Kobusingye, O. (2021). State of pedestrian road safety in Uganda: a qualitative study of existing interventions. *African health sciences*, 21(3), 1498-1506.

Prochaska, J. O., & Di Clemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: theory, research & practice*, 19(3), 276.

Sanga, C., Mlozi, M., Haug, R., & Tumbo, S. (2016). Mobile learning bridging the gap in agricultural extension service delivery: Experiences from Sokoine University of Agriculture, Tanzania. *International Journal of Education and Development using ICT*, 12(3).

Seiterö, A., Thomas, K., Löf, M., & Müssener, U. (2021). Using Mobile Phones in Health Behaviour Change-an Exploration of Perceptions among Adolescents in Sweden. *International Journal of Adolescence and Youth*, 26(1), 294-306.

Traxler, J. (2009). Current state of mobile learning. *Mobile learning: Transforming the delivery of education and training*, 1, 9-24.

Vikrant, S., Sayyad, S., Kumar, A., Vengatesan, K., & Singhal, A. (2020). M-learning for promoting advancements in agriculture: An innovative educational model for Ethiopian farmers. *Advances in Mathematics: Scientific Journal*, 9(7), 5057-5064.

Wanume, P., Nduhura, A., Mugerwa, B., Bagambe, H., & Ninsiima, J. (2019). The dangerous Boda Boda transport mode: Mitigating an impending war on the roads in a transforming city? Case of Kampala City. *Journal of Logistics Management*, 8(1), 1-13.