

Innovation in Developing and Teaching the Management of Micro-mobility

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Abstract

Our paper presents teaching, learning, management, and recommendations for promoting the safe usage of micro vehicles, a trend in today's traffic. However, since we do not know how to use new vehicles in our traffic, the trend of incidents, severe injuries, and even first deaths is quickly rising. Therefore, we are developing tools and good practice examples for promoting the safe usage of micro vehicles, such as e-scooters and e-bikes. We also provide results of our empirical study based on the Stanford Social Innovation Questionnaire, researching common mistakes when using micro vehicles and ways to help promote the safe usage of e-scooters. In conclusion, we provide recommendations for further research. We firmly believe that our educational and teaching change, fostered by innovations in learning, teaching process, and technology for learning, teaching, and curriculum development, can serve as a model for other countries grappling with the challenges of micro-mobility, thereby contributing to the global discourse on traffic safety.

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Introduction

In the field of sustainable development, Hulchak (2022) emphasises the role of mobility management in improving the quality of life and minimising the negative impacts of transport. This is particularly relevant in the context of micro-mobility, which is transforming public transit and creating new opportunities for sustainable travel (Glöss, 2020). Kemppinen (2012) further underscores the importance of mobility management in increasing sustainable travel, particularly in urban areas. D'Acierno (2022) provides a practical application of these concepts, demonstrating how the adoption of micro-mobility solutions can enhance student accessibility in urban areas. These studies collectively highlight the potential for innovation in the development and teaching of micro-mobility management, particularly in the context of sustainable urban development.

Our paper presents teaching, learning, management, and recommendations for promoting the safe usage of micro vehicles, a trend in today's traffic. However, since we do not know how to use new vehicles in our traffic, the trend of incidents, severe injuries, and even first deaths is quickly rising. Therefore, we are developing tools and good practice examples of how to promote the safe usage of micro vehicles, such as e-scooters and e-bikes. Our pedagogical model starts by analysing how students perceive the new trends in contemporary traffic. Therefore, we present their implicit theories of the word "micro-mobility." Then, we will briefly provide students' proposals for promoting the responsible use of micro-vehicles.

Micro-mobility worldwide and in Slovenia

Micromobility is a relatively new term that has been used since 2017. This is also why it is less known among the common population. There are several definitions of micromobility, which cover the breadth of the concept in different ways. One definition broadly defines micro-mobility as any small, low-speed human- or electric-powered transportation device, including bicycles, scooters, electric bikes, electric scooters (e-scooters), and other small, lightweight wheeled transportation (Price et al., 2021).

Micromobility is a crucial element of urban traffic planning. They are primarily used within a range of 10 kilometres. Along with the classic bikes, scooters, and skateboards used for decades, cities face rapid growth in the use of new micromobility travel modes such as electric bikes, e-scooters, and similar vehicles (Slovenska platforma za trajnostno mobilnost, 2021).

Devices related to micromobility can be privately owned, but they usually have shared vehicles maintained by local authorities or private organizations. Rental systems are installed in densely populated areas and are intended for shorter journeys, primarily to solve the problem of the "first and last" kilometre (Price et al., 2021).

Trends in micro-mobility

The number of micromobility users has grown rapidly in recent years, which has significantly affected the market. According to Vantage Market Research, the micro-mobility market was worth nearly 3000 billion dollars in 2020. Their forecast for 2028 is more than tripling that value to 11 000 billion dollars (Vantage Market Research, 2021).

There are several advantages offered by micromobility. The first is affordability. Buying or renting an e-bike or e-scooter is cheaper than traditional means of transport, such as taxis. Another advantage is sustainability. These are small vehicles that cause almost no pollution or emissions. The third important reason is efficiency. Smaller vehicles are efficient and fast over short distances. Above all, they are ideal during rush hours. The fourth advantage is their convenience. Users can rent them in specific

places and use them as they choose since many different means of transport are available for rent by city (Micromobility Market Size and Share Analysis by Service Type (Bike Sharing, Kick Scooter Sharing, Scooter Sharing) - Global Industry Growth and Demand Forecast to 2030, 2022).

There are several reasons for the rapid growth of micromobility users. First is the use of micromobility in tourism. Since tourists want to see several relatively close attractions, micromobility is very important. Also, this method of transport is very practical in more extensive and touristic cities, due to heavy traffic. Another reason is the growing importance of more sustainable modes of transport. Countries encourage the use of alternative transport to cars. Covid-19 contributed to the individual use of means of transport, such as bicycles or scooters, as they did not pose a risk of infection. In 2021, the demand for e-bikes increased by as much as 240 percent (Vantage Market Research, 2021).

Joint research by the Boston Consulting Group and the University of St. Gallen surveyed 11,400 respondents in Europe, China, Japan, and the United States. They found that as income increases, so does the use of micromobility. Residents with lower incomes tend to be less inclined to use micromobility. Although price and culture are factors, in some cities, the main reason is simply a lack of availability outside the city centres (Lang & Herrmann, 2022).

The survey results show that 42% of current users rely on micromobility for leisure activities, 39% for commuting, and 36% for errands. The biggest reasons people chose micromobility were of almost equal importance: flexibility, reliability, price, good weather, safety, and the chance to reduce travel time (Lang & Herrmann, 2022).

Analysis of micro-mobility users in Slovenia

"Slovenian cities have already developed the infrastructure for micro-mobility solutions, and residents are already used to riding bicycles and scooters. These two factors are necessary for the long-term success of such services and something that most European countries are still developing," says Ivan Begović, director of micromobility in Slovenia and Croatia at Bolt. The micromobility trend has emerged because people are trying to avoid traffic jams. Slovenians strive for smart and environmentally friendly ways of moving around cities (Cvjetović, 2022).

Electric scooters have been present in Slovenia for many years. Despite this, the legal field of use of e-scooters was flawed, and they could not legally be used in most public areas. This was changed by the law on road traffic rules amendment in August 2021, which regulated the use of e-scooters. In Slovenia, e-scooters can be used on bicycle paths and along the road's edge in settlements where the maximum permitted speed is 50 km/h. Use is also allowed in pedestrian zones, but the speed must not exceed walking speed (Savinjske Novice, 2020).

Ljubljana, the city of micro-mobility

Ljubljana is the capital of Slovenia, with around 300,000 inhabitants, and the biggest city in Slovenia. Therefore, micro-mobility is the most developed area in this city because the traffic and infrastructure are intended for micromobility users.

In 2019, it was ranked the 14th most bike-friendly city in the world. As many as 300 kilometres of well-maintained bicycle paths are intended for different vehicles. In Ljubljana, you can also find 840 bicycles on the public system named BicikeLJ at 84 stops. Since 2011, when the city bike system was established, almost 10 million people have borrowed a bike (Mestna občina Ljubljana, no date).

Since 2015, four special machines for counting bicycles have been installed in Ljubljana, which counts the number of bicycles brought along the bicycle path. At

these four locations, 3 million bicycle trips are recorded annually (Mestna občina Ljubljana, no date).

Recently, the popularity of e-scooters has also increased in the capital, especially after the arrival of the company Bolt, which rents out e-scooters. The problem arose because the company did not organize places for parking e-scooters. Users parked them on the sidewalks, bicycle paths, or elsewhere, obstructing other pedestrians (Atelšek, 2022).

Violations of traffic rules

The growing number of users of micromobility also results in violations by users of e-scooters and bicycles. For example, a recent problem in the capital was food delivery drivers who use bicycles. Food delivery drivers are paid based on efficiency, so they hurry to do their job. That is why they often break the rules and drive too fast or endanger other participants. The mayor suggested that drivers be marked with numbers to make it easier to find those who do not drive according to the rules (RTV, 2022).

According to the data of the Police Department of Ljubljana, violations in the first half of 2022 increased compared to the same period in 2021. Among cyclists, ten percent increase in violations of road traffic rules and a 50 percent increase in violations by drivers of light motor vehicles (e-scooter users and bicycle drivers of mopeds) (Delo, 2022).

The most frequent violations were related to an incorrect direction of driving, inappropriate speed, the non-use of a helmet, and driving under the influence of alcohol (SioLNET, 2022). In the first six months of 2022, 223 such violations were found among cyclists and 17 among users of light motor vehicles (Delo, 2022). Sixty-three percent of e-scooter drivers did not use a helmet at the time of the accident (SioLNET, 2022).

Accidents of e-scooter users

With the number of violations of road traffic regulations, the number of accidents also increases. The small silhouette of the e-scooter and its inaudibility are the main reasons why it is more difficult for pedestrians and road users to notice. At higher speeds, the possibility of the e-scooter being overlooked by pedestrians is even more significant, which can be very dangerous. Therefore, speed regulation and the use of suitable infrastructure are very important (N1, 2022).

The police started monitoring accident statistics of e-scooters in September 2019. Nine accidents occurred this year, four caused by e-scooter drivers. The e-scooter driver was severely injured in one accident, and there were also five minor injuries. In 2020, the number of accidents increased to 51; in 30 cases, e-scooter drivers caused the accident. A year later, the number of accidents doubled to 109, and e-scooter users were responsible for accidents in as many as 68 cases (SioLNET, 2022). Last year, 232 e-scooter drivers were involved in traffic accidents. Of these, 152 were the perpetrators of traffic accidents. This data shows a rapid increase in the number of accidents and the proportion of accidents caused by e-scooter drivers.

In the University Clinical Center of Ljubljana, the number of patients treated for falls with a scooter and e-scooter is increasing. Most of those treated are children and adolescents up to 18 (SioLNET, 2022). In 2022, 166 e-scooter drivers were slightly injured in 232 accidents, with 30 being seriously injured. Two e-scooter user drivers died. This means that only 15 percent of accident participants did not suffer any injuries.

Injuries

According to traumatologist Uroš Tominac from the University Clinical Center in Ljubljana, accidents with e-scooters in 2019 mainly caused surface injuries. As he says, it is difficult to talk about specific injuries. People are trying to catch themselves on their hands when they fall. A lot depends on the driving speed and the place where the accident occurs. There are a lot of bumps and broken wrists, as well as blows to the head, head wounds, and injuries to the nasal bones and chest. Concussions and broken teeth are often present in injuries (Bizovičar, 2021).

Doctors are most concerned about head injuries, which are the easiest to prevent by wearing a helmet and the most dangerous. In 2020, 480 patients were treated for injuries caused by driving light motor vehicles; in more than half of the cases (56%), they had head or neck injuries (Bizovičar, 2021).

Recommendations for the safe use of e-scooter

- *Use helmet.* The head is the essential part of the body and is also very exposed if you fall from an e-scooter. Since we ride e-scooters in cities, we are surrounded by dangerous objects that can damage our heads if we fall.
- *Be careful about the direction.* By driving in the wrong direction, you obstruct other micro-vehicles driving in the right direction and thus increase the chance of an accident.
- *Do not use your phone.* The use of a telephone or headphones distracts the driver's attention from what is happening in the surroundings, which results in worse responses to unexpected events.
- *Drive alone.* Driving an additional person reduces the stability of the vehicle, which in e-scooters is already worse than in other vehicles or bicycles due to the small wheels.
- *Adjust speed.* If you drive at an adjusted speed, it is easier to avoid accidents, and you can use the brake in time in case of unexpected events. If the driving speed decreases from 25 km/h to 15 km/h, the possibility of an accident decreases by four times. This way, you are less exposed to severe injuries in case of an accident.

Methodology

In the theoretical part, we presented the micro-mobility trend and highlighted the importance of proper management of new vehicles in contemporary traffic. The educational sector here plays a key role. We developed a project where professors, practitioners, and students search and develop the most suitable ways to promote responsible behaviour using micromobility vehicles. This paper presents the study results at the School of Economics and Business, University of Ljubljana. Seventy-eight students filled out the survey at the 1ka platform; 43% were male, 56% were female, and 1% decided not to reveal his/her sex.

Results

Based on 74 received students' associations, we provide a few that we found interesting and also demonstrate that micromobility is a phenomenon in modern traffic that many students are struggling with what exactly this is, and what it means for their transportation habits and new rules of behaviour modulation in the future. Many students said they do not know what the word means or have never heard of it. Some have tried to guess but were not sure:

- “a completely new word”

Some also have a wrong understanding of micro-mobility that needs educational intervention:

- “When I think of micromobility, I think of electric cars.”

Several students associate micro-mobility with electricity:

- “It is the denominator for various means of transport and delivery powered by electricity.”
- “Various means of transport and delivery with electric drive represents a growing industry in the modern world.”
- “By the word micromobility, I understand mobility and means of transport that operate on electric energy.”
- “Mode of transport with more modern means of transport, especially those powered by electricity...”

Several students' first association with micro-mobility was connected to the environmental effect these vehicles have on the environment, such as:

- “Environmentally friendly mobility...”
- “Driving with vehicles that are less or completely harmless to the environment, bicycles...”
- “Driving around town is fun and environmentally friendly at the same time...”
- “Environmentally friendly mobility...”
- “Less polluted mobility, mobility with smaller means of transport...”
- “An environmentally friendly and practical form of mobility, which is mainly used in cities or for shorter distances...”
- “A fun and environmentally friendly type of mobility in the city...”
- “Under this term, I imagine new, more modern, less environmentally damaging forms of mobility, such as electric scooters and electric bicycles, which could be used daily instead of cars, to contribute to the reduction of environmental pollution...”
- “Various electric vehicles & a useful innovation for companies that see this innovation as a possibility and also for the environment and society...”
- “Modes of transport and mobility in the modern urban environment, which do not negatively affect the environment through their operation. Therefore, under micromobility, I would classify means of transport supported by electricity...”
- “Means of transport that are mainly intended for more environmentally friendly driving around the city...”
- “Alternative mobility options and finding solutions for more environmentally friendly mobility...”
- “Sustainable and environmentally friendly solutions to the problem of urban mobility. Especially from the point of view that people do not use private cars for short trips but have an environmentally and city-friendly infrastructure for efficient transport...”

Only a few students saw micromobility as a threat or dangerous and mainly saw it as an advanced technology that protects our natural environment.

Proof citations:

- “Transportation with bicycles, electric bicycles, scooters, skateboards,... a fast, flexible form of transportation in a small space...”
- “You are mobile by using smaller means of transport, such as a bicycle and scooter...”

- “Using advanced technology to travel...”
- “The first thing I think about is that mobility has become micro (not so common anymore). However, it is probably an innovation in mobility and means of transport...”
- “New mobility, a new technology that is not yet fully known. There is something new for everyone. Such as all-new electric vehicles. Which on the one hand are excellent but on the other can also be dangerous.”
- “Too advanced technology approaching us...”
- “use of advanced technology for the needs of an ageing society, disabled people, disabled children...”

Discussion

Only 34% of the students (27 students) in our sample have experience using e-scooters, which shows that the majority are not familiar with the actual usage of this novel micromobility. Similarly, only 34% of the students in our sample (27 students) used e-bikes. However, their attitude towards micromobility is positive. They see many benefits of using them in the future to reduce pollution, especially in cities.

Students think and propose as a form of social innovation that it is necessary to enable everyone access to micro-mobility devices and to make an application that, like Google Maps, would measure how long it takes to travel the distance with an e-bike or e-scooter from point A to point B. In larger cities, stations with electric vehicles such as e-scooters and e-bikes need to be expanded, according to students' opinions. More advertising of micromobility on social media is needed, e.g., a prize game for the most original picture of an individual on an electric scooter. We are contemplating using this student idea in our project dissemination and promotion activities. Raising awareness and encouraging the population to adopt sustainable modes of transport through various marketing techniques (athletes, posters, etc.) and subsidies for purchasing electric vehicles were also proposed. According to our student sample, micro-mobility needs to be brought closer to people through advertising (“flashmobs”). Above all, students think we should bring micro-mobility closer to people and generalise the use of these means of transport so that people take them for granted and do not see them as something out of the ordinary. Students also recommend more bus stops with e-bikes and e-scooter storage. They would offer participating micromobility users some rewards to encourage them further to use micromobility.

Students also see micromobility spread through increased fuel prices, subsidies for purchasing an electric scooter or e-bicycle and promoting e-bicycle use. By adapting the shape of cities to the mode of micro-mobility, several more minor roads that do not correspond to the width of cars could be implemented. City officials could develop a share-and-go network. More significant promotion of the use of micromobility, the form of advertising on radio and television, some lectures at (secondary) schools, etc., were also proposed. The proposal was also to make an application with which an individual would (“accumulate”) points by using micro-mobility or walking to a store, school, workplace... and in this way receive certain benefits.

Conclusion

Our findings show that business students embrace new mobility but lack the knowledge to use them correctly. This is essential information for decision-makers and

city officials worldwide. Knowledge and experience need to be provided to enable students to try micromobility vehicles in a safe environment and develop healthy lifestyles and good habits.

Our study's limitations are related to time and one faculty sample. Further studies are recommended to research the trend of micromobility usage among other age groups, especially children, where habits develop.

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