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RESEARCH ARTICLE

Perceptions of e-Micromobility Vehicles amongst Staff and Students at Universities in the North of England

Gemma Bridge
York St John University, UK
g.bridge@yorksj.ac.uk

Background: Currently, many journeys are under three miles, with most of these journeys completed using private cars. This leads to congestion, pollution and reduced opportunity for physical activity. Swapping private car journeys for walking, cycling or using electric micromobility (e-micromobility) vehicles, such as electric scooters and electric bicycles, could create healthier environments and populations. Whilst e-micromobility vehicles are increasing in popularity, questions remain about how they might fit into current transport networks and how they are perceived by communities. Leeds is striving to become a zero emission city by 2030 and the student and staff population in Leeds is diverse and provides a good opportunity to explore perceptions relating to e-micromobility in the region.
Objective and methods: This study aimed to explore perceptions of e-scooters and e-bikes as key groups of e-micromobility vehicles amongst university staff and students working or studying at universities in Leeds. An online survey was disseminated online via social media, email networks and via Prolific in November 2021.
Findings and implications: Few respondents currently use e-micromobility vehicles. Advantages of e-micromobility vehicles were mentioned and included reduced pollution and convenience for short journeys. Many respondents stated that they would be unlikely to purchase or hire an e-micromobility vehicle soon. Deterrents included cost, concerns about safety and uncertainties about where they can be ridden. Required regulations that respondents mentioned included compulsory training and maximum speed restrictions. These findings could inform future policy relating to e-micromobilities and support transport changes to support ambitions to achieve net zero emissions by 2030 in the region and beyond.

Keywords: e-micromobilities; net zero; e-bike; commute; interviews; surveys

Introduction

Cities and places across the world are facing several economic, health and social challenges, including sedentarism, poor air quality and traffic congestion, all of which converge in the transport sector. Powered micromobility vehicles (herein e-micromobilities) are described as wheeled vehicles that are fully or partially powered, have a curb weight of equal to or less than 500 lb (227 kg) and have a top speed of 30 mph (48 km/h) or less (SAE International, 2019). E-bikes and e-scooters are ultra-lightweight (curb weight of 50 lb (23 kg) or less) e-micromobility vehicles with low top speeds (8 mph (13 km/h) to 20 mph (32 km/h) and are powered by an electric motor (SAE International, 2019).

E-bikes and e-scooters are two of the most commonly used e-micromobility vehicles and have increased in popularity over recent years. E-bikes and e-scooters are popular for private use and ownership. Navigant, a private consultancy, released a report which stated that sales of e-bikes increased from 30.6 million units per year in 2013 to 37.9 million units in 2020 (Navigant, 2020). These vehicles are also popularly used as part of shared schemes, with recent evidence from Bird, an e-scooter start-up company, indicating that the modal share of e-scooters in Paris is currently 2%, whilst it is expected that more than 20% of trips taken could be by e-scooter or e-bike by 2030 (Schuller and Aboukrat, 2019).

The use of e-micromobilities such as e-bikes and e-scooters, which are the focus of this paper, could help to tackle the issues of sedentarism, poor air quality and traffic congestion simultaneously. Compared to car use, e-micromobilities take up less space on roads, thereby helping to reduce congestion (Bahrami and Rigal, 2022) and release minimal emissions, with data from the US indicating that their use in 2020 resulted in the reduction of 29 million pounds of CO_2 emissions (NABSA, 2021) and therefore a net reduction in environmental impacts of transport (Hollingsworth, Copeland and Johnson, 2019). If used to replace private car journeys, they could help to increase physical activity and in turn reduce negative health consequences of being sedentary (World Health Organization, 2020). In support, recent data from North America indicates that trips made by shared e-bikes and e-scooters resulted in 12.2 million additional hours of physical activity (NABSA, 2021).

In the UK, as in several other countries in Europe and North America, policy environments encourage the use of e-bikes (Ruan, Hang and Wang, 2014), with riders permitted to ride on cycle paths on the road and on pavement lanes that have been specifically designed for pedal cycling (MacArthur, Dill, and Person, 2014). For the safety of riders and other road users, there are regulations in place in most countries to restrict the maximum continuous power output of e-bikes to 250–500 W and a maximum speed of 25–40 km/h with assistance. In contrast to e-bikes, privately owned e-scooters cannot be freely ridden in the UK and are governed by the same regulations that apply to other motor vehicles (Hirst, 2021). According to such regulations, without insurance, road tax, licence to ride, number plates or signalling ability, privately owned e-scooters cannot be ridden legally on public roads, cycle lanes or pavements (Hirst, 2021).

E-bikes and e-scooters can both be used via shared schemes. Data from the National Association of City Transportation Officials (NACTO) reported that 6.5 million trips were taken on shared e-bikes in 2018, and 38.5 trips were taken on shared e-scooters (NACTO, 2019). However, access to shared e-micromobility vehicles is not equal throughout countries. In the UK, recent data suggests that most shared e-bikes are located in London (n = 11,500, 68%), with Birmingham having the largest fleet outside of the capital (n = 1,130, 7%) (O'Brien, 2021). In 2021, some new shared e-bike initiatives were launched in the north of England; for example, TIER launched an e-bicycle scheme in York. A similar picture is true of shared e-scooters. Whilst 31 regions across England are taking part in two-year pilot trials of sharing schemes in collaboration with the Department for Transport, access to shared e-micromobilities remains more limited outside of larger cities such as London and Birmingham (O'Brien, 2021).

As more people are using e-micromobilities, it is important to explore perceptions of such vehicles amongst a range of populations whilst also exploring how the increased use of such vehicles may affect existing regulations and infrastructure in local areas. Moreover, as the use of e-micromobility vehicles alters based on season and geography and is strongly influenced by the local context, it is important to understand potential uses as well as perceptions of e-micromobility vehicles amongst regional populations. Doing so could provide decision makers with a better understanding of the potential impact of e-micromobilities on public spaces, the wider environment, public health and road safety and thus enable appropriate infrastructure and regulations to be developed.

Leeds is located in the north of England and is the largest city in West Yorkshire. The city covers an area of 111.6 km^2 (43.1 sq mi) (Wikipedia, 2022). As of 2020, the population of Leeds was estimated to be 798,786, with 10% (n = 79,880) aged 20–24 (LeedsGov, 2022). Not all residents live in Leeds full time; there are approximately 80,000 students across four universities in Leeds, with the University of Leeds having the largest student population of 39,000 students. There are also over approximately 15,000 staff working across the four universities. At the time of writing, no e-bike or e-scooter rental schemes were on offer in Leeds. In terms of travel in Leeds, a recent travel to work survey completed by Connecting Leeds found that in 2021, many commuters (40%) drive to work and just 4.1% of survey respondents travel by bike and 6% by foot (Connecting Leeds, 2022).

Much of the research and investment in e-micromobilities has occurred in the south of England and much of that in London. Improving sustainable transport networks across the UK is important for meeting environmental agendas as well as ensuring that opportunity is spread more equally across the UK in line with the levelling up agenda (Gov.UK, 2022). As e-micromobilities are likely to be an important aspect of such transport networks, it is essential that perceptions of e-micromobilities are conducted amongst a wider population group, both geographically and with a range of groups of society.

Leeds was selected as a case study location for this study because it has made a commitment to be a zero emission city by 2030, with e-micromobilities potentially part of this plan. Moreover, the city has a large student population, with limited car parking on the university campuses highlighting that alternative travel options are needed.

This study aims to address four research questions:

1. Amongst staff and students in Leeds, what is the demographic profile of users of e-micromobility vehicles?
2. What are the main reasons for the use or disuse of e-micromobility vehicles amongst staff and students in Leeds?
3. What are the perceived advantages and disadvantages of e-micromobility vehicles amongst staff and students in Leeds?
4. What regulations do staff and students in Leeds perceive to be needed for the use of e-micromobility vehicles in Leeds?

To answer these questions, an online survey was conducted with staff and students working and/or studying at universities in Leeds. The findings of this study could be used to inform the design and planning of e-micromobilities by offering insights into their perceived capacity to support sustainable transport infrastructure in Leeds and beyond.

This article is arranged as follows: The next section provides a review of available literature on the use and perception of e-micromobilities. This summary of current knowledge is followed by an overview of the study methods and the findings of the research. Penultimately, the article provides a discussion of the findings with recommendations for planners and decision makers in Leeds and beyond. The article concludes with a summary of the work and some suggested avenues of future research.

Literature review

The sale of e-micromobilities, including e-bikes and e-scooters, has been increasing over recent years and is expected to continue to grow (Jones, Harms and Heinen, 2016). In support, the global e-bike market was valued at US$23.89 billion in 2020 (Mordor Intelligence, 2020), with forecasts that the market will reach US$47.45 billion by 2028 (Inkwood Research, 2020). Likewise, the e-scooter market was valued at US$18.5 billion in 2020 (Precedence Research, 2020), with forecasts indicating that the market will reach US$41.98 billion by 2030 (Grand View Research, 2021).

Who uses e-micro mobility vehicles?

In terms of who uses e-micromobilities, based on the "innovation diffusion" model by Rogers (1995), it may be expected that users of e-micromobilities are young, highly educated, relatively wealthy and male—a demographic that also reflects early adopters across a variety of other sectors (Black et al., 2001). In support, there is emerging evidence that indicates that the users of shared e-micromobilities are indeed young and male and have a high income (Reck and Axhausen, 2021).

For e-scooters, data suggests that there is a negative correlation between age and likelihood of buying or renting an e-scooter. A Department for Transport survey found that 16% of those aged 16–24 were likely to buy an e-scooter compared to just 3% of those aged 65+; likewise, 27% of 16-to-24-year-olds were likely to rent an e-scooter versus 3% of those aged 65+ (Department for Transport, 2021). In terms of gender, males are more likely to buy scooters than women (11% of men are likely to buy versus 8% of women; 17% of men are likely to rent versus 13% of women) (Department for Transport, 2021). Regional differences exist; data from the UK indicates that those living in urban areas are more likely to buy and rent e-scooters (Department for Transport, 2021).

In terms of e-bikes, younger individuals are be more likely to be users of docked bike-sharing schemes than those who are older (Chen et al., 2020; Eren and Uz, 2020). Whilst earlier research, such as that from Australia, suggests that private owners of e-bikes are older than the average population (Johnson and Rose, 2015), there is evidence to suggest that private e-bikes are being used more widely, including by younger people in Europe (Becker et al., 2021). In terms of gender, research suggests that males are more likely to join docked bike-sharing schemes than females (Chen et al., 2020; Fishman, 2016). Income has also been found to be mostly positively correlated with docked bike-share usage (Eren and Uz, 2020; Fishman, 2016), as has education; users of docked bike-sharing schemes often show higher levels of education (Eren and Uz, 2020; Fishman, 2016). Research exploring the use of shared non-electric bikes suggests that the weather, land use and built environment can substantially influence use, with similar factors also likely to impact shared e-bike use (Wang, Akar and Chen, 2018). In support, in research from Brisbane, Australia, it was found that the use of shared bikes was correlated with the length of off-road bikeways near each cycle station, and bikes were less likely to be returned to hilly locations (Mateo-Babiano et al., 2016).

Advantages of using e-micromobility vehicles

By encouraging more people to opt for non-private car travel, there are several advantages of e-micromobilities, including reduced local air pollution, reduced congestion and increased physical activity. In support, the most commonly perceived advantages of e-scooters reported in the Department for Transport survey was reduced pollution and improved local environments (Department for Transport, 2021). In terms of reduced local air pollution, e-micromobilities are powered by an electric battery rather than a combustion engine, and as such, they do not emit greenhouse gases when in use. In support, for the same distance travelled by the same number of people, micromobilities emit up to 90% less CO_2 than a conventional privately owned car (International Transport Forum, 2020).

Moreover, as many journeys are short, with data from 2019 indicating that 24% of trips are under one mile and 68% under five miles (Office for National Statistics, 2020), e-micromobilities could be used to replace these journeys and reduce emissions overall. In support, MacArthur et al. (2018) conducted a survey amongst people who own or regularly operate an e-bike within North America and found that replacing car trips was a key reason for using an e-bike amongst this population. By replacing car trips, e-micromobilities could also help to reduce congestion, as they take up less space on the road. In support, in the UK Department for Transport survey, a relatively large proportion (25%) of respondents indicated that they use e-scooters to get to a specific destination, including workplaces, local facilities and amenities, educational settings and the homes of friends or relatives, with others stating that they use them because they are easier than other modes of travel (Department for Transport, 2021). Reductions in congestion could have significantly positive impacts, particularly in heavily congested areas such as cities, by reducing time and money lost due to sitting in traffic (INRIX, 2020).

By promoting physical activity,-e-micromobilities could also confer positive health benefits (Iglesias and Gojanovic, 2011; Louis et al., 2012), and this is particularly true for e-bikes. In support, research has found that e-bikes can increase participation in cycling and encourage more frequent and longer journeys (Fyhri and Fearnley, 2015), with research suggesting that the average weekly distance covered on an e-bike ranges from 15 km (Wolf and Seebauer, 2014) to over 70 km (Winslott Hiselius and Svensson, 2014). E-bikes also give riders the ability to cover greater distances and complete more activities in the same time over conventional cycling, which may enable more journeys to be completed without a private car (Jones, Harms and Heinen 2016). Moreover, as e-bikes reduce the effort required to ride (Engelmoer and Mulder, 2012; Johnson and Rose, 2015) and are comfortable and ecological, they could also help to support sedentary or older people in commuting to work and meeting physical activity guidelines. In further support, evidence suggests that e-bikes could also help to increase accessibility for people unable or reluctant to use other modes of active travel (Gojanovic et al., 2011) and enable those who feel that they have a personal sense of decline in physical ability to become active (Jones, Harms and Heinen, 2016).

Whilst e-scooters are unlikely to confer the same physical activity benefits of e-bikes due to lesser physical effort required, if they can promote active commuting, they could help to reduce the risk of cardiovascular disease and all-cause mortality (Panter et al., 2018). Moreover, there is evidence to suggest that the use of e-scooters has mental health benefits. E-scooters are fun to ride, especially when compared to sitting in a car or using public transport (Jones, Harms and Heinen, 2016). In support, survey research from Paris revealed that users of shared dockless e-scooters largely favoured them for their fun/pleasant dimension (Krier et al., 2021), and other evidence suggests that there is a positive effect on personal wellbeing thanks to the "joy of riding" (Popovich et al., 2014).

Disadvantages of using e-micromobility vehicles

Although there are many benefits of e-micromobilities, there are also several disadvantages that have been mentioned in the literature. One of the key disadvantages is the potential risk of injury to riders or other road users (Du et al., 2013; Papoutsi et al., 2014).

In the Department for Transport e-scooter survey (2021), the safety of riders was one of the overriding themes, having been cited by 53% of respondents. Safety concerns have also been mentioned with regards to e-bike riders. Research that indicated that the erratic behaviour of e-bike users caused increased conflicts with drivers (Bai et al., 2013). Moreover, in survey results from the US (Dill and Rose, 2012), the Netherlands and the UK (Jones, Harms and Heinen, 2016), safety concerns of e-micromobility riders and other road users were highlighted. However, such concerns may not be evidence informed since existing data on the safety of e-bikes suggests that they have a similar safety profile as conventional bikes (Cottell, Connelly and Harding, 2021).

The charging requirements and concerns about the battery lifespan have also been raised as disadvantages of e-micromobilities. Sanders, Branion-Calles and Nelson (2020) explored the use of shared e-scooters in Tempe, Arizona, and reported that finding charged e-scooters was a barrier to their use. The Department for Transport survey in the UK found that charging time was a factor that hindered the appeal of e-scooters amongst respondents. In terms of e-bikes, research conducted in Portland, Oregon, found that many people had "range anxiety" (i.e., the fear that the e-bike has insufficient battery power to reach its destination), and this was perceived as a significant barrier to e-bike use (Dill and Rose, 2012). In support, Jones, Harms and Heinen (2016) also found that people in the UK and the Netherlands also had range anxiety which deterred people from using or purchasing e-bikes (Jones, Harms and Heinen, 2016). Beyond such anxiety, research indicates that there are environmental challenges posed by the manufacture and disposal of batteries of e-micromobilities (Weiss et al., 2015). In support, in terms of their environmental impact, e-scooters have higher life cycle impacts than walking, cycling and public transportation (Hollingsworth, Copeland and Johnson, 2019).

What is more, e-micromobilities may deter users from more active modes of travel that could have greater health benefits, such as walking, running or cycling. In support, survey research conducted in Paris revealed that shared dockless e-scooters mainly replaced walking and public transportation (Krier et al., 2021). However, whilst energy expenditure per unit time for e-biking is lower than conventional cycling, and although e-bikes are less environmentally friendly than using conventional bikes for the same journeys, the differences are small when compared with using other forms of motorised transport, such as a car, and the activity required is still sufficient to count as at least "moderate intensity" physical activity (Gojanovic et al., 2011).

Beyond the above, there are concerns about the appropriateness of infrastructure. For instance, Jones, Harms and Heinen (2016) reported that parking was problematic, particularly at major transport hubs such as rail stations. In the literature, there are also worries about other people's perceptions of e-micromobility riders. For instance, Popovich et al. (2014) reported that stigma associated with riding an e-bike versus a conventional pedal cycle deterred some people from opting for e-bikes, whilst Jones, Harms and Heinen (2016) reported that some users felt that e-biking was in some way "cheating" compared to conventional pedal cycling. However, recent research indicates that if policies were developed to influence behaviours—for example, by enabling more people to use e-micromobility vehicles—then attitudinal change could follow (McCarthy et al., 2021).

Changes in travel behaviours from use of e-micro mobility vehicles

To understand the potential impact of e-micromobility vehicles on factors such as congestion, air pollution and public health, it is important to explore how the vehicles may displace travel by other modes of transportation, including private cars, public transport and walking (Bigazzi and Wong, 2020; Cairns et al., 2017; Weiss et al., 2015). Research suggests that e-micromobilities can displace other modes of transport. In support, research conducted in the UK found that over half (52%) of respondents reported having reduced their use of at least one mode of transport since they started using an e-scooter (Department for Transport, 2021). Cairns et al. (2017) explored e-bike use in Europe and assessed use during a pilot in

Brighton, UK, and reported that the proportion of e-bike trips that replaced a car journey ranged from 47% to 76%, with an overall reduction in car mileage of 20%. Furthermore, other research has found that the desire to substitute car journeys is the key driver of using e-micromobilities (MacArthur, Dill and Person, 2014).

Despite reductions in private car use, other research noted that e-micromobility vehicles may wean people away from more active modes of travel, such as walking or running (Behrendt, 2013). Support for this comes from Austria, where early adopters of e-bikes were mainly car-owning older people who were using e-bikes for leisure trips and no discernible changes in commuting or shopping trips were reported (Wolf and Seebauer, 2014). Furthermore, recent research found that whilst e-bike journeys replaced private car trips for many users (24%), e-bike journeys also replaced public transport (33%), conventional bicycles (27%) and walking trips (10%) (Bigazzi and Wong, 2020). However, the replacement of active journeys does not appear to be true everywhere, with survey data from France suggesting that shared e-scooter riders have not significantly reduced how much they walk (Krier et al., 2021).

Current e-micromobility regulations

With the rise in use of e-micromobilities occurring in several places across the world, questions are being asked about what regulations may be needed to ensure that they can be used safely. One particular area of interest is where e-micromobilities can be ridden, with much thought focused on e-scooters. In the UK, as of May 2022, the use of privately owned e-scooters on public roads is illegal (Hirst, 2021). However, most respondents (60%) to the UK Department for Transport survey on e-scooters thought it should be legal to ride e-scooters in cycle lanes on the road, whilst a minority (14%) thought that e-scooters should not be legal to ride in any public areas (Department for Transport, 2021). Several pilot trials of rental e-scooter schemes were run across the UK in "Future Transport Zones", with evidence of high demand and safe usage. In support, in the Department for Transport survey (2021), 9% of respondents thought it was likely that they would buy an e-scooter if they were legal to use on the roads of the UK. A recently published report by the Centre for London recommended that national government should legalise private ownership and safe ridership of e-scooters alongside shared schemes (Cottell, Connelly and Harding, 2021). Following similar calls for legalisation of e-scooters, Ireland recently published draft legislation to allow for the regulation of e-scooters and e-bikes, creating a new vehicle category, "Powered Personal Transporters" (PPTs) (Department of Transport, 2021). Regulation of e-micromobilities may lead to riders needing to complete training or to hold a licence. In Malta, following a series of complaints and accidents, legislation was implemented for e-scooter riders, which means that riders must be over 18 years of age, hold a driving licence and be insured. All riders must also purchase a one-time registration fee as well as an annual licence fee of €25 (Twisse, 2020). Likewise, in some US states, such as Kansas; in the Canadian state of Quebec; in the Philippines (Trajkovski, 2020); and in Dubai, e-bike and e-scooter users are required to hold a driving licence (Gulf Today, 2022).

Another area of concern around e-micromobilities is the speed at which they are legally allowed to travel. In 2020, the Italian Transportation Ministry published new rules for e-scooters, and as such, they can now be driven in public spaces but at stipulated speed limits, with a maximum speed of 25 km/hr on carriageways where bicycles are allowed and a maximum speed of 6 km/hr in pedestrian areas (Twisse, 2020). In support, in the Department for Transport survey (2021), a large majority (85%) of respondents thought a maximum speed limit for e-scooters was important. Also, in a recently published report by the Centre for London, it was recommended that national government should enforce that all riders of e-scooters must keep with a maximum permitted speed (Cottell, Connelly and Harding, 2021). However, it is likely that such speed regulations will need to be regularly reviewed, since there are newer models of e-micromobilities entering the market that can reach much faster speeds. For instance, Dutch e-bike company VanMoof recently announced that it is introducing an e-bike that can reach up to 31 mph (VanMoof, 2021).

Methods

The relatively sudden appearance and rapid expansion of e-micromobilities has challenged policy makers and planners, including those in the UK, and has raised planning, regulatory and infrastructure questions. Whilst there is a growing interest in the area of e-micromobilities, many of these questions remain largely unanswered, especially on local and regional levels. The aim of this study was to conduct an online survey to explore perceptions of e-micromobilities amongst staff and students at universities in Leeds.

Survey tool

The survey was developed based on a literature review of current e-micromobility-related research (e.g., Denver Public Works, 2019; Department for Transport, 2021; Portland Bureau of Transportation, 2018). The survey was approximately ten minutes in duration and included 22 questions, although skip logic was included and so some respondents were shown fewer questions. The survey included questions on the following topics:

- E-micromobility usage (both personally owned and for hire)
- Perceived advantages and disadvantages of using e-micromobility vehicles
- Opinions about current and future regulations and infrastructure for e-micromobility vehicles
- Sociodemographic factors (age, gender, ethnicity and occupation at a university)

Recruitment

The online survey was developed and input into Qualtrics. The survey was conducted in November 2021 and ran for two weeks. A link to the survey was distributed via Twitter and email networks to reach staff and students from universities in Leeds. Due to limited responses online, to capture insights from a diverse range of people, the survey was shared with potential respondents via Prolific, a survey recruitment platform.

Analysis

Once the survey was closed, the data was downloaded from Qualtrics into Excel. Once in Excel, the data was cleaned, removing any partial or duplicate responses. Responses from those who were not studying or working at a university in the north of England were also removed. The data was then descriptively analysed in Excel to assess frequencies and the demographic profile of respondents. Further analyses to segment respondents by ridership frequency, age and ethnicity were considered, but due to the small number of respondents in each group, it was felt that conclusions that could be drawn would be too constrained to be meaningful. This underscores the need for additional research with a larger population in this area of study.

Ethics and consent

The research was conducted in accordance with the Declaration of Helsinki. The research was approved by the Leeds Beckett ethics committee. The reference number is 88891. The respondents in the study were kept anonymous, with each respondent given a unique ID number. No names were recorded. Prior to taking part in the survey, all respondents were provided with information about the study and were asked to provide consent to take part. They were also given contact details for the lead researcher as well as the ethics review board, should they have had any questions about the study or ethical review process. All potential respondents were invited to take part in the survey voluntarily and were informed that they could stop the survey at any time.

Results

The results of the survey, which are summarised below, help to answer the four research questions posed.

Demographic profile of the survey respondents

The online survey was completed by 205 respondents. However, due to difficulties with geolocating and refining responses on Prolific, of those, 160 of the responses were completed by people who were not self-described as being a student or a staff or faculty member at a university in Leeds; as such, these responses were removed. Forty-five completed surveys were retained for analysis. Most respondents had a UK nationality (n = 43, 95%) and were aged between 18 and 24 (n = 25, 55%). Over two-thirds (n = 29, 66%) were students. Just under half (49%) were female. Responses were provided from staff and students at the University of Leeds, Leeds Trinity University, Leeds Beckett University and Leeds City College. The demographic breakdown of the respondents included in the analysis is summarised in **Table 1**.

Who uses or may use an e-micromobility vehicle amongst staff and students at universities in Leeds?

Most respondents (n = 31, 68.9%) had not used an e-micromobility vehicle before. When explored by sex, more men (n = 8) had used a micromobility vehicle than women (n = 6). When looked at in terms of age, 44% (n = 11) of those aged 18–24 had used an e-micromobility vehicle compared to just one of those over age 40. When asked the likelihood of purchasing an e-micromobility vehicle, most (n = 37, 82%) stated they would not be likely to do so in the next three years (very unlikely (n = 8), not at all likely (n = 12), not very likely (n = 17)). Of those that stated it was very unlikely or not at all likely, most were female (n = 20, 54%). Of those that stated they would be very likely to purchase an e-micromobility vehicle (n = 8), most (n = 6) were men.

When asked the main deterrent from buying an e-micromobility vehicle, cost, preferring to walk or cycle without power assistance and safety were highlighted. Additional reasons provided as free text included restrictions to their use on private roads ("The vehicles cannot be used on roads or public places so I don't see the point of them" (female, staff member at Leeds Trinity University)); the perception that e-micromobility vehicles are not cool ("They are not a very 'cool' or attractive way of transport" (male, staff member at Leeds Beckett University)); and e-micromobilities not seeming relevant ("I'm not a bike kind of a person" (female, staff member at the University of Leeds).

In terms of hiring an e-micromobility vehicle, a small majority (57%, n = 26) stated that they would be quite likely or very likely to hire one in the next three years, with most of those being male (n = 17, 65%). Of those that stated that they would be not at all likely or not very likely to hire an e-micromobility vehicle, most were female (n = 13 compared to n = 6). When asked about deterrents from hiring an e-micromobility vehicle, cost, concerns about safety and preferring to walk or cycle without power assistance were mentioned most often.

Demographic variable	Count (%)
Age group	
18–24	25 (48)
25–34	13 (28)
35–44	3 (6.7)
45–54	2 (4.4)
55–64	1 (2)
Employment status	
Full time	20 (46.5)
Part time	14 (32.56)
Not in paid work	1 (.3)
Unemployed	3 (6.98)
Starting soon	1 (2.3)
Other	4 (9.3)
Gender	
Male	23 (51.1)
Female	22 (48.8)
Status at a university	
Student	29 (64.4)
Faculty/staff member	16 (35.5)
Nationality	
British	43 (95.5)
Irish	1 (2.2)
Italian	1 (2.2)

Table 1: Demographic summary of respondents.

Purpose of an e-micromobility vehicle

Respondents were asked for which purposes they would use an e-micromobility vehicle. Of the purposes given, travelling to a destination for leisure was the most frequently mentioned reason (n = 24, 53%). Using the vehicle for fun was also frequently mentioned by respondents (n = 22, 48%). Of the respondents that were students, 37% (n = 17) stated that they would use an e-micromobility vehicle to travel to university/college, whilst only one of the staff members stated that they would use an e-micromobility for this purpose (see **Figure 2**).

When respondents were asked how far they would travel using an e-micromobility vehicle, most (n = 28, 62%) stated they would cover between one and three miles. This was apparent in students (n = 17) and staff (n = 11). Only one respondent (a 28-year-old male staff member at Leeds University) stated that he would travel more than six miles using an e-micromobility vehicle.

Perceived advantages and disadvantages of e-micromobility vehicles

In terms of the perceived advantages of using an e-micromobility vehicle, the ability to reduce pollution was the most frequently mentioned advantage (n = 41, 91%). Other advantages included the convenience of e-micromobilities for short journeys (n = 27, 60%) and their potential to reduce congestion (n = 31, 68%) (see **Figure 1**). The most frequently mentioned disadvantage of e-micromobility vehicles was concern for the safety of pedestrians (n = 31, 68%). Other disadvantages frequently reported included concern for the safety of riders (n = 27, 60%) and charging requirements (n = 25, 55%).

Potential changes in travel behaviours from use of e-micromobility vehicles

When asked about potential changes to travel behaviours as a result of using an e-micromobility vehicle, the most frequently reported potential change was to walking, running or cycling (n = 26, 57%). Many respondents stated that they would reduce their use of buses (n = 22, 48%) or private cars (n = 19, 42%).

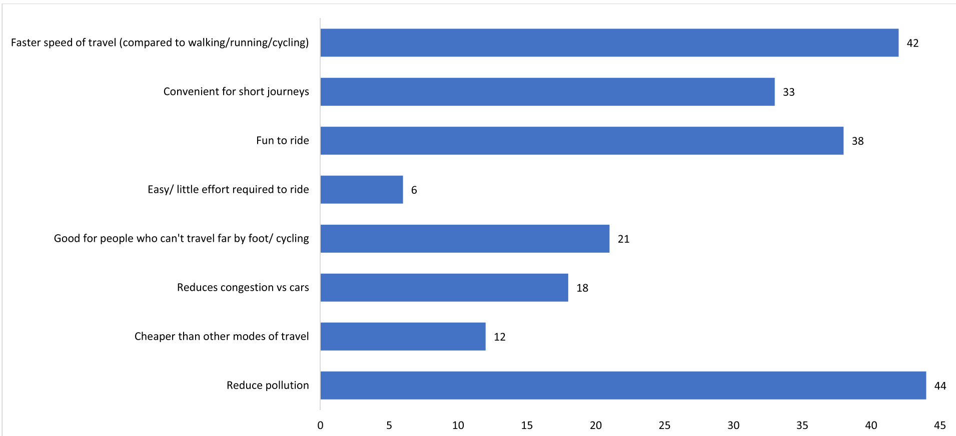

Figure 1: Advantages of e-micromobility vehicles.

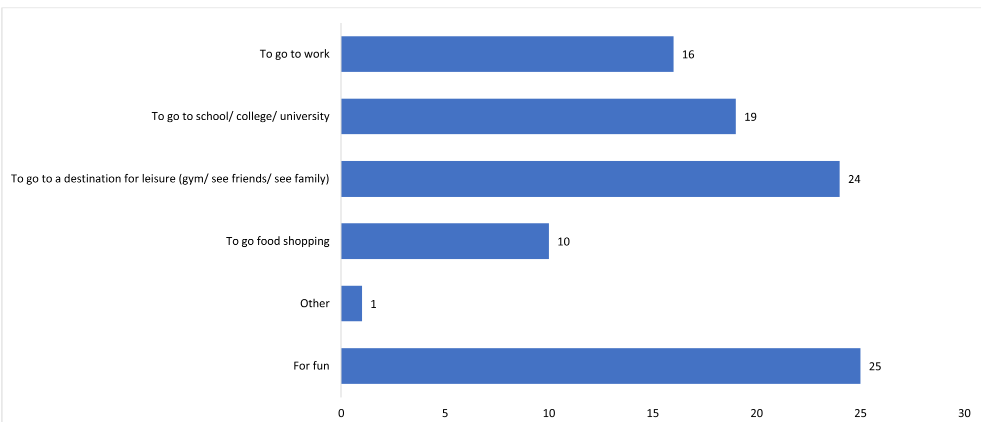

Figure 2: Proposed purposes of an e-micromobility vehicle.

Perceptions of regulations for e-micromobility vehicles

When asked about where it should be legal for e-micromobility vehicles to be ridden, most respondents (n = 41, 91%) stated that they should be ridden in cycle lanes on the road. Riding e-micromobility vehicles on dedicated e-micromobility lanes on the road was mentioned by many respondents (n = 31, 68%). In terms of regulations, implementing a maximum speed limit was mentioned by the largest proportion of respondents (n = 36, 80%). Many respondents (n = 35, 68%) stated that users of e-micromobility vehicles should complete compulsory training. Several respondents (n = 16, 35%) stated that riders should have insurance.

Discussion

The aim of this study was to explore perceptions of e-micromobility vehicles, including their potential usage and advantages and disadvantages, amongst staff and students at universities in Leeds. To the best of the author's knowledge, it is one of the first studies to explore perceptions in the particular population. Whilst the sample size is small, the paper highlights some important considerations for future research and could provide insights for transportation and planning in Leeds.

The survey results indicate that more males had used an e-micromobility vehicle in the past. This supports previous research (Krizek and McGuckin, 2019; Reck and Axhausen, 2021). Research from Denver, Colorado, indicated that the gender split was approximately 70/30, with more males using shared e-bikes (Denver Public Works, 2019). Reasons for the gender gap in e-micromobility use may be explained by females feeling less comfortable using these vehicles due to concerns about safety, which was put forward to explain differences in rates of bicycle use amongst men and women (Singleton and Goddard, 2016). Similar findings were also reported in a 2019 study conducted in the US, whereby safety was a key factor deterring females from using e-micromobility vehicles (Sanders, Branion-Calles and Nelson, 2020). To reduce the gender gap in the future, policy makers and planners could look to develop and enforce safety regulations, such as developing compulsory training programmes or giving riders and other road users tickets or cautions for driving unsafely.

Despite the finding that previous use was greater amongst males, when the likelihood of purchasing an e-micromobility vehicle was explored in the present survey, no clear difference in gender was found, and most of the respondents stated they would not be likely to do so in the next three years. This contrasts with previous findings but may be explained by the young population included in the survey. However, when the likelihood of hiring an e-micromobility was explored, a small majority of respondents stated that they would be quite likely or very likely to hire an e-micromobility vehicle in the next three years, and of those that were likely to hire a vehicle, a small majority were male. This supports previous research that identified a male slant in e-micromobility usage, as described above. This finding may reflect concerns about safety or range anxiety.

Reasons for not wanting to hire or buy an e-micromobility vehicle were varied in the present study, but cost was the most frequently mentioned factor. This finding reflects previous research; for example, MacArthur et al. (2014) reported that the non-trivial difference in cost between conventional bikes and e-bikes was a deterrent for potential buyers. Other deterrents for hiring and buying e-micromobility vehicles reported in the present survey included a preference for walking or cycling without power assistance. This supports some previous research, such as that by Sanders, Branion-Calles and Nelson (2020), which indicated that almost half of respondents (46%) to their US university–based survey were happy with their current transport options and not interested in using an e-scooter.

The preference for walking and cycling in the present study may also reflect the young demographic of respondents. As promoting walking and cycling can help to improve population health, they should be encouraged further, and this could be done alongside efforts to support people to opt for lower or zero emission transport options when the journey is longer than they feel capable of making on foot or by pedal bike. The focus of efforts to promote e-micromobilities for shorter journeys (i.e., those under two to three miles) should be towards those who may otherwise not walk or cycle in order to not result in people reducing current walking and cycling. Efforts could be multi-faceted; for example, alongside updated policies and new infrastructure to help users of e-micromobility vehicles to feel safe, workplaces could encourage more of their employees to make the most of financial assistance schemes, such as the UK's Bike to Work scheme. Moreover, local authorities could look to develop more affordable long-term loan schemes for university staff and students, such as those in Leeds, as well as the wider community to enable more people to use an e-micromobility vehicle regularly.

With regards to hiring an e-micromobility vehicle, many respondents also indicated that they had concerns about safety and about where the vehicles could be ridden. Such concerns have also been reported in previous research. For instance, Sanders, Branion-Calles and Nelson (2020) stated that worries about feeling unsteady or falling off an e-scooter and concerns about not having safe places to ride were mentioned as barriers to use by many respondents to their survey. Furthermore, in the free text responses, respondents reported that they felt that e-micromobilities were "uncool", which put them off from both hiring or buying a vehicle. This supports previous research by Popovich et al. (2014), who reported that stigma associated with riding an e-bike deterred some people from using them; similarly, Jones, Harms and Heinen (2016) mentioned that some people feel that using an e-micromobility vehicle is perceived as "cheating". Therefore, to further promote use of e-micromobility vehicles as zero emission transport options that can help to fill a niche in current urban transportation, it will be important for providers, public agencies and policy makers to address safety concerns, clarify regulations so that potential users are clear about where to ride and highlight the utility of these vehicles over private cars. Training schemes that include road user safety, identifying safe routes to use and the benefits of zero emission transport options could be particularly useful.

When respondents were asked how they would use an e-micromobility vehicle, most indicated that they would use an e-micromobility vehicle to travel to a destination for leisure (e.g., going to the gym, visiting a friend). When explored by student and staff populations, students stated that they would be likely to use the vehicle to travel to school, university or work. In support, research from Denver reported that almost a third of respondents (32%) to a survey on e-scooter use used a vehicle to get to/from work, whilst 20% reported using them to get to/from a destination for entertainment (Denver Public Works, 2019). Moreover, the findings reflect research from Portland, Oregon, which found that over 70% of people who had used an e-scooter had most frequently used it for transport to or from a destination (Portland Bureau of Transportation, 2018). Furthermore, the findings also support research from the UK Department for Transport, which found that many respondents reported using e-scooters to get to workplaces and educational settings and to visit the homes of friends or relatives (Department for Transport, 2021).

When respondents were asked the distance expected to travel on an e-micromobility vehicle, regardless of where they were travelling, most respondents expected to cover between 1 and 3 miles. This estimated distance per trip reflects previous research conducted by Krizek and McGuckin (2019), which found that 75% of trips carried out by e-micromobility users in several US towns and cities were shorter than 2.5 miles (median trip length 1.2 miles). This suggests that as many personal journeys in the UK are under 3 miles, encouraging more people to use e-micromobility vehicles could help to shift personal car trips to an alternative zero emission mode. In support, previous research suggests that e-micromobility vehicles can result in the displacement of other modes of transportation, including private cars, which could further support carbon-reduction ambitions (Bigazzi and Wong, 2020; Cairns et al., 2017; Weiss et al., 2015). However, in the present research, when respondents were asked how they expected to change their travel behaviours if they were to use an e-micromobility vehicle, few respondents stated that they expected that an e-micromobility vehicle would encourage them to reduce their private car use. Instead, respondents stated that they would reduce their use of public transport or expect to do less walking, running or cycling. Such changes could be detrimental and result in reduced health benefits of active travel. To better understand the potential impacts of such uses, it would be useful to conduct further research to understand the potential long-term health impacts of e-micromobility use if they are indeed used in place of walking or cycling trips.

Despite few respondents stating that they would be likely to purchase an e-micromobility vehicle, many respondents highlighted several advantages of using these vehicles. Reduced pollution was the most frequently mentioned advantage. This reflects previous research which indicated that the most commonly perceived advantage of e-scooters was reduced pollution and improved local environments (Department for Transport, 2021). In the present study, the convenience of e-micromobilities for short journeys and their potential to reduce congestion were also highlighted by many. However, respondents also stated that such vehicles have several disadvantages. The cost of e-micromobilities was the main disadvantage given. Many also stated that they have concerns over the safety of pedestrians and riders. Such concerns reflect previous research that indicated that the risk of injury to riders or other road users was a main barrier to e-micromobility use (Du et al., 2013; Papoutsi et al., 2014).

In terms of regulations, it was found that most respondents in the present survey felt that a maximum speed limit should be set for e-micromobility users. This reflects previous research that found that a maximum speed limit for e-scooters was important (Department for Transport, 2021). Many respondents in the present study also stated that e-micromobility vehicles should be ridden in cycle lanes or on dedicated micromobility lanes. Again, this reflects findings from the UK Department for Transport survey on e-scooters, whereby most respondents thought it should be legal to ride e-scooters in cycle lanes on the road (Department for Transport, 2021).

Strengths and limitations of the study

Whilst every effort was taken to achieve a survey sample that was as representative of the student and staff population in Leeds as possible, the sample size was small, and most of the respondents were students aged 18–24. This will limit the generalisability of the perceptions to the wider population in Leeds and outside of the city. Moreover, although Prolific was used to increase sample diversity, it is possible that there may be respondent bias from those who were more interested in a subject and therefore more likely to participate in this research. This may also affect the generalisability of the results to the wider student and staff population in Leeds. Despite these limitations, the findings are largely consistent with what other studies have found in other locations; therefore, these findings are still likely to provide useful insights that, when combined with findings from other research from the same area, can be used to inform decisions about e-micromobility vehicles, infrastructure and regulation in the region.

To further strengthen the present study, additional research could be conducted to explore perceptions of e-micromobility vehicles, including e-scooters and other newer modes, amongst a wider population. Particular efforts to include people living in lower socio-economic areas as well as people living with disabilities should be taken, as much previous criticism of transport policies relates to overlooking the lived experience and perceptions of these population groups. Furthermore, as safety was highlighted as a barrier to e-micromobility use and may explain gender gaps, it would be useful to conduct research to gain a holistic understanding of the safety of e-micromobility vehicles across a variety of settings. Such research could help to ensure that practitioners can best plan for safe travel for riders and other road users and also to understand how to better accommodate e-micromobility vehicles such that harm is mitigated and opportunity for all is increased.

Conclusion

E-micromobility vehicles are becoming increasingly popular in the UK and the world over. Such vehicles could play an increasingly significant role in helping to promote low carbon transport and healthy cities. However, to enable these vehicles to integrate successfully within the fabric of the wider transportation ecosystem and ensure that infrastructure, regulations and polices are developed appropriately, understanding who the likely users are and how local people may perceive and respond to these vehicles is important. This paper provides an exploration of perceptions of e-micromobility vehicles, their use and potential advantages and disadvantages amongst a specific population. Whilst the study population is small and therefore generalisations of the findings are limited, the data suggests that more males have used an e-micromobility vehicle in the past, indicating that there may have been a gender gap in e-micromobility use. Previous research suggests this could be explained by concerns around safety. Moreover, whilst most respondents are aware of the array of potential benefits of e-micromobility vehicles, few reported that they would be likely to purchase a vehicle in the near future. Whilst the likelihood of hiring a vehicle was greater, several drawbacks of e-micromobility use were mentioned, including safety, lack of local infrastructure and cost. Such findings could be influential, helping to inform policy and decision makers in Leeds and the wider area about e-micromobilities.

Competing Interests

The author has no competing interests to declare.

Author Contribution

Gemma Bridge is the sole author of this paper. Dr Bridge conceptualised the study, conducted the data collection and analysis and wrote all drafts of the paper.

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