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Versteijlen, Marieke; van Wee, Bert; Wals, Arjen

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Exploring sustainable student travel behaviour in The Netherlands: balancing online and on-campus learning

Marieke Versteijlen

Department of Education and Learning Sciences, Wageningen University and Research, Wageningen, The Netherlands and Avans University of Applied Sciences, 's-Hertogenbosch, The Netherlands

Bert van Wee

Transport and Logistics Group, Delft University of Technology, Delft, The Netherlands, and

Arjen Wals

Department of Education and Learning Sciences, Wageningen University and Research, Wageningen, The Netherlands

Abstract

Purpose – Daily commuting trips of higher education (HE) students account for a large proportion of the carbon footprint of a HE institution. Considerations of students underlying their choice of travel mode and their decision to make the trip to campus or to study online are explored as a necessary first step for finding an optimal balance between online and on-campus learning from both a sustainability and an educational perspective.

Design/methodology/approach – Focus group conversations were held with student groups from different study programmes of a university of applied sciences in the Netherlands.

Findings – Dutch students' travel mode choices seem to depend on measures regulating travel demand such as a free public transport card and high parking costs. The findings indicate that students make reasoned choices about making a trip to campus. These choices depend on considerations about their schedule, type, lecturer and content of a course, social norms and their own perceived behavioural control. Alternative online options can provide students with more flexibility to make choices adapted to their needs.

Social implications – While these findings are useful for sustainable and educational reasons, they also seem helpful in times of COVID-19 which calls for a re-design of curricula to allow for blended forms of online and on-campus learning.

Originality/value – To the best of the authors' knowledge, this paper is one of the first studies looking at students' considerations when deciding whether to travel to campus to learn or stay at home learning online.

Keywords Carbon footprint, Higher education, Online learning, Class attendance, On-campus learning, Student travel behaviour

Paper type Research paper



1. Introduction

Stimulating a shift to low-carbon travel modes is one of the recommendations of the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2014, p. 603) to countries for lowering their greenhouse gas (GHG) emissions. Many countries are looking for ways to lower their GHG emissions and are thus trying to meet the 1.5-degree target as set in the Paris Agreement (UN, 2015, chap. 21). According to the IPCC, transport is responsible for 23% of global GHG emissions (in 2010) (IPCC, 2014). However, the IPCC also recommends: “avoiding journeys where possible” (IPCC, 2014, p. 603). This study focuses on students’ journey from home to their educational institution, considering both IPCC recommendations.

Globally, many university students commute almost every day to their institution, contributing to GHG emissions and air pollution. Having an online learning alternative may decrease these travel movements. Information and Communication Technology provides educational institutions with capabilities to deliver a course (or part of a course) location-independently, using the internet. An obvious requirement is that organising a study program that significantly reduces student travel should not compromise the quality of education. Making a conscious attempt to decrease travel movements is, as far as we know, in an educational context unexplored territory. In the few studies about student travel behaviour, a modal shift from car to alternative (lower-carbon) travel modes is the main topic of interest, especially in countries with a high car dependence like Canada (Whalen *et al.*, 2013), the USA (Zhou, 2012) and Australia (Hancock and Nuttman, 2014).

The significant environmental impact of student travel becomes clear by looking at the carbon footprint of higher educational institutions (HEIs). The carbon footprint is an indicator of the magnitude of GHG emissions caused by activities of an individual, a group or an organisation (WBCSD, 2014). Many universities and colleges worldwide are looking for ways to reduce their carbon footprint as one response to what is increasingly referred to as “climate urgency” (UoE, 2019). Studies about the carbon footprint of a HEI are rare (Li *et al.*, 2021), and only some of these studies include student travel in their measurements. The reported estimations of the annual carbon emissions owing to students’ commuting vary between 300 and 630 kg CO₂ per student in countries, such as the UK (Caird *et al.*, 2015; Ozawa-Meida *et al.*, 2013), the USA (Bailey and LaPoint, 2016) and The Netherlands (Versteijlen *et al.*, 2017). While most universities consider travel-related emissions as a significant part of their carbon footprint, they tend to focus on (long-distance) travel of staff to international meetings and conferences, often by plane, ignoring the much more frequent local commute-related student travel (Hopkins *et al.*, 2016; Versteijlen *et al.*, 2017).

Besides environmental considerations, a natural disaster or crisis may be another reason for HEIs to restrict student travel temporarily. During the COVID-19 pandemic, the most frequent initial response of higher education (HE) in countries categorised as developed economies was to close campuses, followed by an immediate transition from on-campus to an online learning environment to support students to continue with their studies (Crawford *et al.*, 2020). This rapid movement to digital education has exposed deficiencies in existing infrastructure, pedagogic knowledge and teachers’ experience (Ali, 2020). HE needs to improve the resilience of their academic programs to be prepared for unanticipated interruptions (Ali, 2020; Mackey *et al.*, 2012). This first exploration, aiming at reducing student travel by location-independent learning using the internet, can be helpful.

This paper presents the results of a study on travel behaviour of Dutch students. The Netherlands distinguishes itself from other countries through a combination of high population density, a high-quality infrastructure (for travelling by car, bicycle and public transport) and a strong cycling culture (Belgiawan *et al.*, 2014). In The Netherlands, approximately 75% of the student trips to campus are done with a low-carbon travel mode,

that is, public transport (ca. 50%) or bicycle (ca. 25%) (CBS, 2016). This is partly because of the characteristics mentioned above and other factors, which will be discussed in the subsequent sections. Because most Dutch students seem to make a sustainable travel mode choice, more sustainable gain could be obtained from decreasing the number of trips to campus. Dutch students travel on average 45 min on a weekday for educational purposes (CBS, 2016). Therefore, in this study, the emphasis lies on the potential of (online) learning activities to mitigate the number of student trips to campus. In addition, lessons may be learned from the Dutch approach to stimulate students to choose a low-carbon travel mode.

To make a study program possible that mitigates education-related student travel emissions as well as maintains, or ideally improves, study quality, the first crucial step needed, and aim of this study, is to explore students' considerations and (de)motivators influencing their travel mode choices and their decisions whether to travel to their institution or to study (online) from home or a place that does not require travelling. In addition, account is taken of the possibility that studying at home stimulates a student to increase travelling to non-study activities. Hence, measuring travel emissions needs to consider the direct as well as the indirect effects of studying at home. Therefore, if "education-related student travel" is mentioned, we refer to all (direct and indirect) domestic student travel because of their education. We limit ourselves to regular full-time students, who represent the majority in HE.

The education-related travel behaviour of Dutch HE students is explored based on the following two research questions:

- RQ1.* What are the perceptions, attitudes and preferences of students involved in the process of choosing a particular travel mode to commute to campus and to make a trip to campus to attend learning activities?
- RQ2.* From a student's perspective, to what extent could substituting in-class meetings with online learning be an appropriate measure for reducing their travelling?

Based on a literature review, we will first provide a theoretical background on factors influencing students' travel behaviour, which converges into a conceptual model. We will then introduce the methodology and methods used to answer the two research questions. The presentation of the findings makes up the central part of the paper to end with a discussion and a conclusion.

2. Reviewing theory about students' travel choices

HE students are in many aspects, but certainly not all, socio-economically speaking, a homogeneous group with similar characteristics. Students are generally unmarried, have no children, have a lower (or even no) income and are younger of age (Zhou, 2012). Travel behaviour research is usually aimed at understanding people's travel behaviour in general to support the development of effective transport policies (van Wee *et al.*, 2013). The next sections discuss to what extent theoretical concepts from travel behaviour research can be applied to student travel behaviour.

2.1 Hierarchical decision structure

The concept of a hierarchical decision structure (Salomon and Ben-Akiva, 1983; Van Acker *et al.*, 2010) is useful for understanding how the differences with the general population might influence students' travel behaviour. This hierarchical decision structure distinguishes long-term, medium-term and short-term decisions of individuals. Long-term decisions are, for instance, decisions on lifestyle. Lifestyle is defined as "the pattern of

behaviour which conforms to the individual's orientation toward the three major roles of a household member, a worker and a consumer of leisure, and which conforms to the resources available" (Salomon and Ben-Akiva, 1983, p. 624). Medium-term decisions, such as location choices in relation to study/work, are made in conjunction with the adopted lifestyle (Van Acker *et al.*, 2010). Short-term decisions on daily activities and travel are expressions of behaviour determined by lifestyle and the associated locational choices (Van Acker *et al.*, 2010).

Applying the hierarchical decision structure to education-related student travel, long-term decisions, such as, whether to adopt a family-oriented (living with parents) or an independent lifestyle is, besides academic reputation of the HEI, an important determinant for the medium-term decision in choosing a university (Briggs, 2006). The choice of location, where to live or study, influences the travel mode, the distance to campus and probably even the number of trips. In most cases, students who continue to live in their family home will have to travel to campus with public or motorised transport. In contrast, students who live independently relatively close to the campus can often cycle or walk. One of the topics of this study is whether a longer travel time affects the motivation of students to attend learning activities on campus, thus affecting the number of trips.

Although the long-term and medium-term choices of students affect regular students' daily activities and travel behaviour, it will be considered out of scope for this study.

2.2 Education-related travel behaviour choices

Studying full-time in HE allows students to have control over their study schedule. Daily, students have to decide if they will attend an on-campus learning activity and how to commute. In travel behaviour research, an individual travel behaviour decision is often considered from an economic, geographical and psychological perspective (Van Acker *et al.*, 2010; van Wee *et al.*, 2013). From an economic viewpoint, an individual is considered a rational human being making consistent and efficient choices that maximise its utility (Avineri, 2012). Time geography describes the path of an individual through time and across space in which activities require joining with others at a certain time and location as well as accessibility of destinations (Hägerstrand, 1970). From a psychological perspective, an influential theory is the theory of planned behaviour (TPB) (Ajzen, 1991). According to this theory, individual behaviour results from an intention dependent on attitude, social norms and perceived behavioural control. Attitude refers to how a person evaluates or appraises a particular behaviour. Social norms refer to the perceived social pressure and perceived behavioural control to the perceived capability of performing the behaviour (Ajzen, 1991). TPB assumes that behaviour results from a reasoned choice, and this assumption does not always apply. Within a static situation, a behavioural choice can respond to past experiences and can result in an automated reaction (Gardner, 2009; Verplanken and Aarts, 1999). Applying this to student travel behaviour, an initially chosen travel mode by students will become a habit (Haggar *et al.*, 2019) in contrast to the (probably) reasoned choice of a student to travel to campus to attend learning activities. In two studies about students' attendance decisions, the TPB framework nevertheless proved to be an accurate model to explain the intention and behaviour to attend a lecture on-campus (Ajzen and Madden, 1986; Hollett *et al.*, 2020). These studies found perceived behavioural control to be the strongest predictor of this attendance decision. However, the effect of having the opportunity of watching an online lecture is not considered in these studies. Unlike the NOA model, which shows that behavioural choice is affected by needs (N), opportunities (O) and abilities (A) of a person (van Wee *et al.*, 2013, chap. 3), the standard conceptualisation of TPB does not explicitly include alternative choice options.

In this study, the focus lies on the short-term behavioural travel choices of individual students. Following the theoretical psychological concepts, depicted in Travel for Learning (Figure 1), a

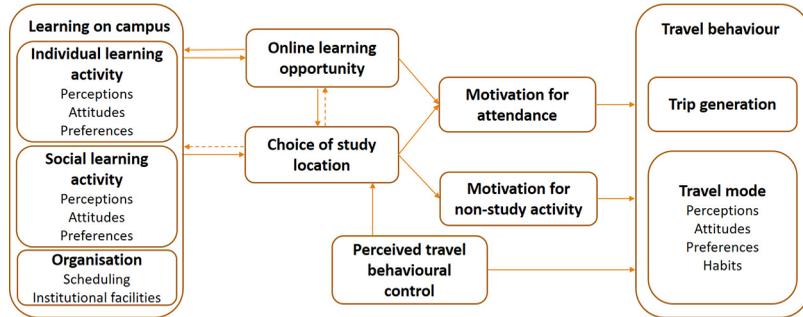


Figure 1.
Initial conceptual
model: travel for
learning

Notes: Based on: conceptual model of travel behaviour (Van Acker *et al.*, 2010), NOA model (van Wee *et al.*, 2013, chap. 3), Theory of Planned Behaviour (Ajzen, 1991). Dotted arrows refer to feedback mechanisms as a result of learning from experiences

student's travel behaviour probably stems from a motivation to attend learning activities on campus. This motivation, or in TPB terms, "intention," may depend on their evaluation of the actual learning activity. This can be an individual learning activity, like a lecture, practice or self-study or a social learning activity like collaboration. In their evaluation, students' perceived study abilities probably were taken into consideration. In addition, contextual factors, e.g. scheduling issues, may influence their decision to attend (Moores *et al.*, 2019). The choice of where to study may also be affected by a student's evaluation of travel constraints, such as distance and duration of travel and travel costs. Substitution of on-campus learning activities with online learning will provide students with an opportunity to study location-independently and may affect the need to travel to campus. Moreover, it may have an indirect effect because being at home may affect student travel through an increased motivation for non-study activities.

3. Methodology

Dutch students' travel mode choices and commuting in relation to the received education is a relatively unexplored territory. Therefore, we used an explorative methodology, that is, focus group discussions, to better understand the complexity surrounding students' preferences and attitudes towards their travel behaviour. We opted for focus groups because a group of students interacting with each other about their views can provide insight into their thoughts and beliefs, especially in more homogenous groups with a high level of trust (Clifton and Handy, 2003; Stewart and Shamdasani, 2014). Nevertheless, there may be a danger of "contaminating" social influences such as conformity and social desirability," especially for groups that focus on sensitive topics (Hollander, 2004, p. 610). In our focus groups, the topic of discussion is not sensitive for the students. Some of the precautions we took to reduce "contaminating" social influences will be discussed in the subsequent sections.

3.1 Context

We conducted our research in 2019 during March–May at Avans University of Applied Sciences (Avans UAS). Avans UAS has a wide range of bachelor studies and a large number of students (26,725 full-time students, 09-10-2018) divided over four cities (Den Bosch, Tilburg, Breda, Roosendaal), thus providing the opportunity to select students from various bachelor studies and different study cities. We have chosen a UAS because, compared to

university students, a larger number of UAS students commute by car or public transport to their educational institution (Versteijlen *et al.*, 2017).

Two travel demand management (TDM) measures, that is, strategies to change travel behaviour, influence the travel mode choice of the Dutch participants. First, in The Netherlands, all HE students receive a free public transport permit and second, Avans UAS does not facilitate parking of cars for students. Students can park their car in a parking garage, paying an hourly rate or can try to find free parking space in the neighbourhood of the institution (which is difficult).

3.2 Participants of the focus groups

Student recruitment was done by a notification on their digital learning environment followed by an appeal during an in-class session. As compensation for their efforts, we offered them lunch during the session or minimum hourly wages.

Five focus groups were organised with 28 full-time students (12 female, 16 male). A senior student may easily overrule a student with less experience, so the participants were divided according to their study phase. Two focus groups (FG2, FG3) contained 11 first- and second-year students and three focus groups (FG1, FG4, FG5) 17 third- and fourth-year students. The bachelor studies involved (number of students in brackets) are Informatics (8), Communication and Multimedia Design (1), Business Administration (2), Finance and Control (2), Accountancy (4), Social Work (7), Civil Engineering (2) and Building Engineering (2). Regarding the participants' travel distance, four participants live in the neighbourhood of the campus and can cycle or walk. A total of 24 participants have a travel time of approximately between 20 and 120 min with public transport. Four of the participants study in Breda, two in Tilburg, 17 in Den Bosch and seven on the eastern side of Den Bosch.

3.3 Moderator and interview guide

The focus groups were led by a moderator experienced in sustainable transport policy with no relationship with the students. The main researcher (first author) observed all focus group meetings while notes and audio and video recordings were made.

The topic of discussion was introduced to the participants beforehand by mail. At the beginning of the sessions, they were assured that all their statements were to be treated confidentially. Subsequently, they were asked to fill in a consent form and to provide some personal data: name, year of birth, gender, place of residence, place of study, bachelor study, study year and commuting information with regards to travel modes and the number of trip generations per week (over the previous three weeks). To have an individual starting point and prevent group bias, we asked them to draw their preferred way of travelling to the institution (in green) and the less preferred alternatives (in red) on a pre-printed A3 sheet (Appendix: Figure A1, Figure A2). We provided some icons students could use to make drawing a little easier (Appendix: Figure A3). In addition, we asked them to use stars to indicate the likelihood of coming to campus for particular learning activities:

- * I never come to campus for this
- ** I sometimes come to campus for this
- *** I often come to campus for this
- **** I always come to campus for this

The interview guide contained all the questions and some clues about what can be expected of the student's answer. The sessions lasted on average 1.5h. The complete planning of topics of discussion during the session is depicted in Table 1.

3.4 Data analysis

The recordings were all transcribed and anonymised. Every participant can be identified with a code containing:

FG[number of focus group]_[gender (M/F)][number of participant]

All drawings and personal data were digitised. All transcriptions were analysed using Atlas.ti qualitative analysis software (version 8), taking the following steps:

- (1) *Scissor-and-sort method* (Stewart and Shamdasani, 2014).

The first step was to go through all the transcripts, identify fragments of text relevant to the research questions, and give these fragments a code. This resulted in 81 codes. Examples of codes are: “Acquisition online-f2f” or “Appreciation online lecture.” A set of sorted materials was yielded by categorising the codes into code groups. The defined code groups are: acquisition, practice, self-study, collaboration, student, lecturer, course schedule, online communication, travel mode and travel issue.

- (2) *Focus group coding*

A personal profile of each participant was created by combining personal data, data from drawings and their paraphrased quotations (ordered according to the code groups, using Step 1). It provided the possibility to analyse the interdependencies of the personal data of the participants and their opinions.

- (3) *Collecting constraints and motivators of travel mode and trip generation*

The profile of Step 2 was used to collect, in keywords, all constraints and motivators stated by the participants about travel mode and trip generation (translated into English and depicted in tables). An example of a table item can be seen in Table 2.

Table 1.
Planning of the session

Topic of discussion	Time (minutes)
Introduction	5
Travel drawing creation	15
Travel mode	20
Attendance learning activities: lecture, practice, self-study, collaboration, online learning substitution	30
Other aspects: social contact, social norms, course schedule, environment	10
Travelling to non-study activities in relation to educational design	5

Table 2.
Constraints and motivators uttered by participants about public transport. Number in brackets is the frequency

Subject	Consideration
<i>Public transport use</i>	
Constraint	Unreliable (3), crowding (4), unpredictable (2), transfer, delay, long travel time, accessibility
Motivator	Environment, convenient, travel to city (2), short travel time (2), reliable, other activities during travel (4), no costs (5), personal chauffeur, bad weather conditions

- (4) *Defining attitudes and collecting associated perceptions towards travel mode and trip generation*

With the information of the preceding steps, the attitudes and associated perceptions of the participants were distilled. These attitudes and perceptions were translated into English and depicted in a table. An example can be seen in [Table 3](#).

4. Results

The focus groups offered rich information on all topics of discussion. As much as possible, the findings are presented according to the planning of the topics ([Table 1](#)). The attitude of students towards these topics is, in most cases, illustrated by quotes.

4.1 Travel mode

In [Figure 2](#), the preferred travel modes of the participants commuting to campus are depicted (from their drawings). Approximately half of the participants have access to a car by owning, sharing or borrowing.

Most participants consider public transport as the preferred mode of commuting ([Figure 2](#)). The attitudes and perceptions that underlie these preferences and the actual choices will be discussed in five themes: travel costs, travel time and reliability, travel convenience and environmental considerations.

4.1.1 Travel costs. Students tend to have a low income, so travel costs are an important issue when choosing a travel mode.

We travel with public transport free of charge, I mean, you guys, too, with our student travel permit, you're crazy if you don't use it (FG5_M2).

Attitude	Perceptions
At home, concentration is better	FG5_F2: I prefer studying at home. Because it is a large space here [campus], you hear everything and I am easily distracted

Table 3.
Example of attitude and perceptions about self-study

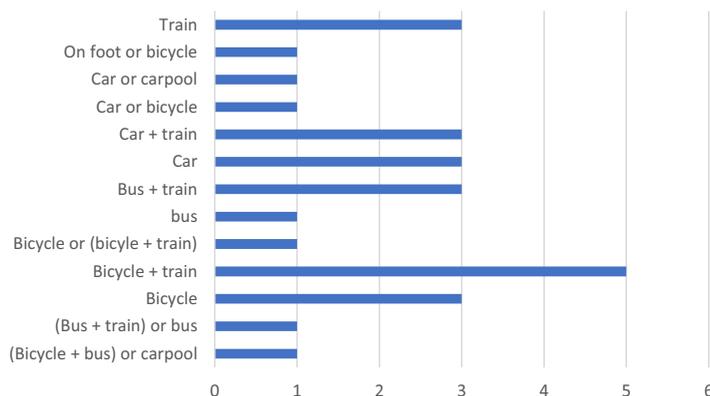


Figure 2.
Count of preferred travel modes of participants (from the drawings)

The participants frequently mention the high cost of travelling by car. Especially, having to pay parking costs is a reason for not taking the car. It was the main reason for two participants to switch from car to public transport for commuting to campus. Occasionally, this is dealt with by taking the car only for short campus visits, as this reduces the costs of parking.

So, what I really look at is: will it cost me money and does it take too much time. Because I want to be there as soon as possible so that I can be productive. If it takes me too long, I will grab the car and park it as close to campus. Often, in case of short visits or just having a meeting and then I'll be gone again immediately. So, if I have to be there all day, I never take the car (FG5_F1).

4.1.2 Travel time and reliability. Travel time seems less of an issue for the participants than costs. However, one participant who had a total travel time of 4 h to attend class eventually chooses to move: "I didn't really plan to move. I thought: oh, I'll hang on, but it's really not doable" (FG3_F3). So, there seems to be a limit to an acceptable travel time. Another participant finds a solution in combining car and public transport to optimise travel time and travel costs.

To be on time for an exam is when the travel mode needs to be reliable. There is no consensus on which strategy works best. All students leave early, but some take the train and others the car to be on time.

4.1.3 Travel convenience. The convenience of travel definitely plays a role in choosing a travel mode by the participants. Some like to travel by public transport because they can perform other activities during their travel time.

I like it pretty much. [...] I'm always on that train and if I have to do: things for school, for example learning or programming (FG2_M4).

Others value the freedom of choice to have a detour option to go to other activities after their on-campus attendance. A participant states about using a car:

Always a place to sit. After college, I have a lot of activities and I have the freedom, taking little time, to go to other places immediately instead of going home first (FG1_M6).

Needing storage space or dealing with bad weather conditions is also mentioned as reasons to adapt their travel mode to a car.

4.1.4 Carpooling and cycling. Only one participant mentioned carpooling as a serious option for commuting. Most participants found it challenging to organise having few or no fellow students in the neighbourhood, and when they did, these students would usually have a different class schedule. Having an excursion is mentioned several times as an occasion for carpooling.

Most participants started to laugh when we mentioned the possibility of using an e-bike. They agree on the fact that using an e-bike is more for elderly people. Some participants emphasise the active and relaxing value of cycling.

4.1.5 Environmental considerations. Most participants agree that choosing a travel mode has to do with costs and time rather than environmental considerations. Only two participants mentioned the environment as a reason to travel by public transport.

4.2 Trip generation: attending learning activities

On average, the participants commute approximately four times a week to campus. They commute because they are supposed, but not obliged, to attend a learning activity. [Figure 3](#) shows the average of valuation which indicates how the participants evaluated the various learning activities at the beginning of the focus group meeting (explained in Section 3.3). These averages have to be considered only as a first indication.

The attitudes and perceptions that underlie these participants' valuations (Figure 3) and the online equivalent (except for self-study) will be discussed per learning activity. The participants had varying experiences with online learning, so we provided them with implementation examples. In addition, some general subjects will be discussed: peer pressure, socialising with peers and course scheduling.

4.2.1 Lecture. During a lecture, the lecturer conveys theoretical concepts, often supported by a digital presentation of slides, in front of an audience that may amount to 100 or more students. Usually, there is little interaction between the lecturer and the students.

Having a lecture as the only learning activity on a day is, in most cases, not enough reason for the participants to commute to campus:

My attention span isn't long enough for a lecture [. . .], but if I have to come to school or stay at school especially, then I'm like: No, I'm not going to travel for three hours in total to attend. And I even don't learn much (FG3_F1).

Concentration loss during a lecture is a recurring theme among the participants. Still, most participants are convinced that knowledge transfer by a lecturer is a necessity, but the way it is done in a lecture is a point of discussion. Some participants experience a lecture as useful for learning:

I learn the most from these lectures because when something is explained to me, in most cases, I understand immediately what is said. It is not necessary to study this at home once again (FG2_M4).

I like that everyone is doing the same thing. In one way or another, it gives me more focus (FG5_M1).

The participants state that they can be motivated to attend a lecture by having other learning activities on the same day, an inspiring lecturer and difficulty/usefulness of the subject. Demotivating for attendance is: not being missed, prior knowledge, no time to ask questions or other opportunities to acquire the concepts discussed in the lecture.

4.2.1.1 Online lecture. What if a lecture has been recorded on video and made available on a digital learning platform? "Then it will be a very deserted campus [laughter]" was the first reaction to this question in FG1. On the whole, there was consensus among the participants about the usefulness of online registration of a lecture. FG3_F3 states:

Sometimes you don't understand a sentence or something and you don't want to ask for an explanation in a full lecture hall. At home you can rewind the recording.

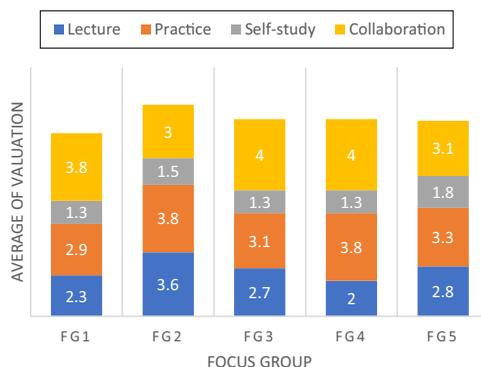


Figure 3.
Average of valuation
(1–4) of the learning
activities by the
participants per focus
group

Other advantages mentioned are: watching anytime, anywhere (even while travelling), more time for making notes, refreshing knowledge before exams. Nonetheless, some participants favour attending a live lecture:

Being there live, you experience it much better than when you see it on video. Personally, I learn a lot more by attending a lecture than watching a video registration of a lecture (FG2_M2).

4.2.2 Learning by practice. During a practice class, an individual student applies his/her understanding of the theoretical concepts by completing an assignment, prepared and supervised by a lecturer. The organisation depends on the study: in economics and informatics, a practice class is a mix of theory and assignments. Technical studies need all kinds of technical facilities, and in social studies students need each other to practice communication skills. A practice class contains approximately 16–32 students, and usually, attendance is required.

Attendance in a practice class cannot be taken for granted. Especially if it is the only learning activity during a day, the participants consider the usefulness and necessity of attending. They value the interaction with the lecturer and fellow students during the practice class:

[...] doing assignments and if you don't get it, you can ask immediately [...] and you hear feedback of fellow-students about how they made their assignment (FG2_M3).

Getting feedback on an assignment is mentioned quite often as being important:

[...] if I don't go, I feel insecure about the quality of my work. I won't have the possibility to double-check if everything is in order (FG1_F1).

Still, one of the participants states:

I'd rather have a specific block of time, let's say, eight hours, working on some subject at home, and learning a lot, instead of every week one hour here and one hour there on campus (FG1_M1).

A lecturer will probably notice whether or not a student is present. So, although it may not be obligatory, the participants feel occasionally obliged to go, because they do not want to offend the lecturer.

4.2.2.1 Online learning by practice. What if you do your assignments online supported by a digital learning environment that facilitates the interaction with the lecturer and fellow students?

For participants of social studies or civil engineering, this seems out of the question because students of social studies need each other to practice social skills while students of civil engineering need facilities: "I have no [water] basin of 20 cubic meters at home" (FG5_M1). However, they see potential in online materials which can prepare them for practice class. Another influencing factor is having face-to-face interaction with fellow students:

It is like when you compare your assignment with someone else, you look deeper into why you did what you did and why he did what he did [...] and online: many times you get the inclination already to type something before the other person finished to make his point (FG2_M3).

Some participants already experienced and appreciated what feedback online might entail in the form of Frequently Asked Questions online or a screencast with which they can check their assignment elaboration.

4.2.3 Self-study. Self-study is location-independent learning of theoretical concepts or completing assignments without the supervision of a lecturer. A student may study at home,

in the library of the UAS or some other study location in the neighbourhood of his/her residence.

There is no consensus about the best place to study among the participants, at home or on campus. Next to travel time, getting distracted is the main consideration when choosing a proper location for self-study. Some participants get distracted at home: “[. . .] on campus I am not tempted to play a computer game or something like that” (FG2_M2). Others complain about the surrounding noise of other students when studying on campus:

I like to study at home, nice and quiet (FG4_F1).

Travel time is an issue when considering whether or not to go to campus for studying:

I am not going to campus for this, no, that really provides no added value for me [. . .] and often, after travelling by bus, you arrive tired (FG5_M1).

Most participants agree that they do not need face-to-face contact to get answers to questions from fellow students. They use WhatsApp or a phone call to communicate with their fellow students.

4.2.4 Collaboration. For collaborative learning, a group is formed of four to eight students. They have to construct something, which is necessarily done through participation and negotiation with fellow students (Laurillard, 2013).

The participants agree that collaborating to make an assignment needs a physical gathering at least once a week. They mention the UAS as a central and neutral meeting point. For some participants, the main reason for gathering is organising the work.

What I like is meeting once a week with your project team on one or half a day, and the remaining tasks are distributed and carried out at home (FG1_M3).

In addition, the physical meeting is experienced as productive and motivating. Social control is also mentioned as a motivator.

4.2.4.1 Online collaboration. The participants did not have much experience with digital environments that support online collaboration. They mention WhatsApp, Skype and Discord as tools for digital communication. These tools are better suited for one-to-one communication. The following narrative illustrates what can happen if you only communicate using WhatsApp:

At a certain moment, we had to make a film, and we had to hand it in on Monday after the Christmas holidays. Well, of course, no one wanted to meet during the Christmas holidays. Well, really, WhatsApp exploded. People got out of the group app and nobody wanted to communicate with each other anymore. It was just a big mess. That was caused by many misinterpretations via WhatsApp because you don't have someone's face in front of you and also, someone asks the same question for the 1000th time because no one has read the apps properly (FG3_F3).

In addition, they mentioned distraction as a constraint to collaborate online:

You're more distracted. You're on your computer. The Internet is just a few clicks away and before you know it, you're looking for something else (FG4_M2).

4.2.5 Course schedule. Only a few participants, mainly first-year students, state that they always go when a lesson is scheduled. The reasons mentioned not to attend class, even if it is scheduled, are: only one class scheduled during a day or the scheduled class occurs after 15:30. A motivator to go to campus is having a fully scheduled day.

That's what we've had in our first year. [. . .] You just have a lecture in the morning, then you can work all day on assignments, practice in groups or alone, and afterwards, you can ask questions and have a feedback moment with the teacher. I appreciated this system (FG5_M1).

4.2.6 *Peer pressure and socialising*. Some participants experience peer pressure to attend classes:

I also experience a bit of peer pressure because some students, they always go . . . then you feel kind of bad if you have missed a few (FG1_F3).

It may also go the other way around:

If in the groups app someone says: I won't go to campus, half of the group members will not go either (FG3_F4).

Collaborating to do an assignment demands the engagement of all the group members and, as one participant mentioned, not only to participate in completing the assignment but also to attend supporting courses.

Collaborating in a group may also stimulate attendance for wanting to socialise with group members.

I really like it on campus. I think it's a reason to go. I would find it very boring if I would only get education at home, [. . .] I also attend class because I just like my learning team (FG3_F5).

Still, there are also opposing opinions about this socialising aspect.

for social contacts I don't go to campus [laughs] [. . .] I rather go to a pub. I'm just for myself and for my group mates on campus[. . .] (FG5_M1).

4.3 *Trip generation: online learning in relation to travelling to non-study activities*

The participants were asked how it would change their travel behaviour to non-study activities if part of the on-campus learning activities were substituted by online learning.

Most participants think that it would not increase their number of trips to non-study activities. Their non-study activities, e.g. meeting friends, often take place in the neighbourhood of their residence. They also think that the decision to go to an activity further away, for instance, going to a concert, is not influenced by spending a day on campus. Some think that it would change the moment when they plan non-study activities.

Then my own time is easier to plan. Okay, this evening let's go crazy: we go to the theatre. Why? Because I have the time for it. I don't have to be at school early tomorrow. Yes, okay, I have to take my homework into account, but I also have a Saturday or a Sunday and the evenings (FG5_F2).

Still, it also depends on where you live and the availability of a car.

I would certainly study [at home, online], but it's also: gosh, I'm going to get a cup of coffee at someone's place, or I'm going to the gym. [. . .] The village nearby that is already about 10 km. Then I grab the car and I drive to my friend and back (FG4_M2).

5. Discussion

Our objective was to gain insight into the considerations of HE students choosing a travel mode and making a trip to campus as well as the potential effect of online learning on this travel behaviour. We will limit our discussion to the three key travel aspects covered in this research: travel mode choice, trip generation and travel to non-study activities. In addition, study limitations and recommendations for future research will be discussed.

5.1 Travel mode choice

Dutch students tend to choose low-carbon travel modes, that is, public transport or bicycle, to commute to campus (CBS, 2016) as is the case with our participants. Influencing factors mentioned include having a free public transport permit and high parking costs near the campus. Other influencing factors for choosing a travel mode include travel time, reliability and convenience. Environmental considerations were rarely mentioned. This latter observation corresponds with findings from a study conducted in the UK, in which more focus on students' awareness of sustainability-related issues in HE is advocated (Green *et al.*, 2012). Overall, the participant's choice of travel mode seems to be a habitual choice considering their individual drawings and commute information, confirming the findings of earlier studies (Gardner, 2009; Hagggar *et al.*, 2019). The habitual travel mode choice is reconsidered when a change in normal circumstances occurs, such as having an exam, only needing to be on campus for a short visit or bad weather conditions. Safety issues are not mentioned in our findings in contrast to studies from other countries (Maguire and Morris, 2018; Miralles-Guasch and Domene, 2010). This may be because of an adequate Dutch infrastructure regarding public transport or bicycle usage.

The potential effectiveness of travel-regulating measures (TDM) to change student travel mode choices is demonstrated by the value the students attribute to travel costs, also confirmed by other research (Whalen *et al.*, 2013; Zhou, 2012). However, it should be noted that probably a combination of TDM measures, such as, in our case, a free public transport permit and high parking costs, is necessary to stimulate a change to a lower-carbon travel mode (Sultana, 2015). An additional long-term effect of encouraging students to opt for low-carbon transport systems is a possible negative impact on their intention to purchase a car after their studies (Muromachi, 2017).

5.2 Trip generation

The decision to make a trip to campus seems to be a reasoned choice and results from an intention to engage in a particular behaviour concerning class attendance. The preferences and attitudes of the participants stem from an evaluation of both the number and the time of the day of the scheduled classes and the kind of learning activity, as depicted in our initial conceptual model (Figure 1). Their perceived study abilities are part of their evaluation of the learning activity. Examples in our findings of its influence are: the ability to concentrate, the perceived complexity of theoretical concepts and the need for feedback and answers to questions. With respect to the social environment, some participants mention pressure from peers and lecturers persuading them to attend. The kind of lecturer, required facilities and study area of the learning activity also seem to be influencing factors of attendance and can be categorised under "institutional facilities," next to scheduling. About scheduling issues, Moores *et al.* (2019) concluded, after a review of studies exploring attendance in HE, that the timing of scheduled classes probably is an issue for some students. Our findings confirm this conclusion. When having a single learning activity on a day, an activity late in the afternoon or, long gaps between activities, students often decide to skip these learning activities. Most students showed a positive attitude towards clustering learning on campus on one or two days per week in the sessions. All these (de)motivating factors concerning learning on campus are weighed against the perceived behavioural control over travel constraints (e.g. costs, time and distance) and the opportunity to learn online instead.

The weight this online opportunity receives in the attendance decision is different for each type of learning activity. Learning activities like collaboration and practice are considered important to attend on campus. The participating students agreed that collaboration needs face-to-face contact on a regular basis. Practice classes on campus are

valued because of the opportunity to get instant feedback or answers to questions from the lecturer and fellow students and practical reasons such as learning facilities only available on campus. Studying in the library or only having a lecture is usually not enough reason for the participants to make a sometimes long and tiring journey to campus. Their negative attitude regarding studying in the library contradicts the findings of [Regalado and Smale \(2015\)](#), which showed that commuter students from the City University of New York valued the library as a distraction-free place for academic work. Most students were positive about knowledge acquisition by using online lectures. They valued the possibility to replay the explanation of theoretical concepts. The effectiveness of online lectures seems to depend on the students' perceived study abilities ([Montrieux et al., 2015](#); [Von Konsky et al., 2009](#)). Alternative online options, like online lectures, can provide students with more flexibility to make reasoned choices adapted to their needs.

5.3 Travel to non-study activities

Limiting on-campus learning on one or two days per week might not lead to increased travelling to non-study activities. Overall, the participants think they will not travel more to certain activities but may plan them differently. Increased travelling by students seems to depend on the opportunities for activities and social contacts in their immediate residential area, and in addition, it may depend on car availability. However, this increased travelling will happen according to the concept of constant travel time budgets (TTB), which states: "that over a large group of individuals, e.g. a country, people on average have quite stable TTB of around 60–75 min per person per day" ([Van Wee, 2015](#)). The existence of a constant TTB is disputed: it may be so that these TTB are only constant at the most aggregate level ([Mokhtarian and Chen, 2004](#)). The requirement of surveying a huge group of students makes it challenging to prove whether the concept of constant TTP applies to student travel.

5.4 Study limitations and recommendations for future research

This small-scale qualitative research project, meant as a first exploration, reveals many of students' considerations. The (quantitative) extent to which these considerations affect a student's choice of travel mode or motivation to attend a course cannot be assessed with such a small group of participants associated with the same HEI. This exploration could be used to examine its findings on a larger scale. In future research, the high dependency on the context of the students' environment should be taken into account, especially infrastructural differences with the Dutch situation as explained in the introduction, implying the inclusion of multiple HEIs.

The participants had limited experience with online learning platforms for collaboration and practice purposes. Now that many students have experiences with online learning owing to the COVID-19 pandemic, it would be interesting to compare our findings with the current perceptions, attitudes and preferences of students about online learning as a substitution for on-campus learning.

Analysis of the transcripts of the focus group meetings relied on the judgement of a single analyst. The analyses were conducted in four steps to lower the chances for subjectivity and potential bias, each from a different perspective (explained in Section 3.4).

6. Conclusion

The influence that HEIs can have on a students' choice for low-carbon travel modes seems limited. Our findings show that their travel mode choices mainly depend on costs (having a free public transport permit) and an adequate infrastructure for bicycle and public transport (promoting reliability, convenience and safety), which are, in most cases, measures at a

national level. HEIs can contribute to these measures by imposing parking restrictions for students. Although a HEI's influence on students' travel mode choice seems to be limited, there are opportunities to affect students' number of trips from residence to educational institution (and vice versa). Especially, schedule measures and creating online learning opportunities probably can make a difference. Therefore, we recommend that HEIs experiment with limiting on-campus learning on one or two days per week supplemented with online learning. This has two major advantages: a reduction of their carbon footprint by a decrease of education-related student travel and a potential enhancement of the attendance rate of the courses. Furthermore, adding a virtual course environment to the physical learning space makes education much more flexible (time- and location-independent) (Vaughan, 2007). This is an important asset in light of the experience gained during the COVID-19 pandemic. A curriculum with such a course schedule should be designed as a responsible mix of face-to-face and online learning (so-called blended learning). Pedagogic principles, such as creating (digital) opportunities for sharing resources, discussion, getting feedback, reflecting on learning experiences and community-building, should be incorporated in this design. Such a hybrid or blended design may deliver a contribution to combatting climate change while at the same time ensuring educational quality. In either case, it sets an example to the students by practising what is advocated in the mission and vision of many HE institutions.

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Corresponding author

Marieke Versteijlen can be contacted at: marieke.versteijlen@wur.nl

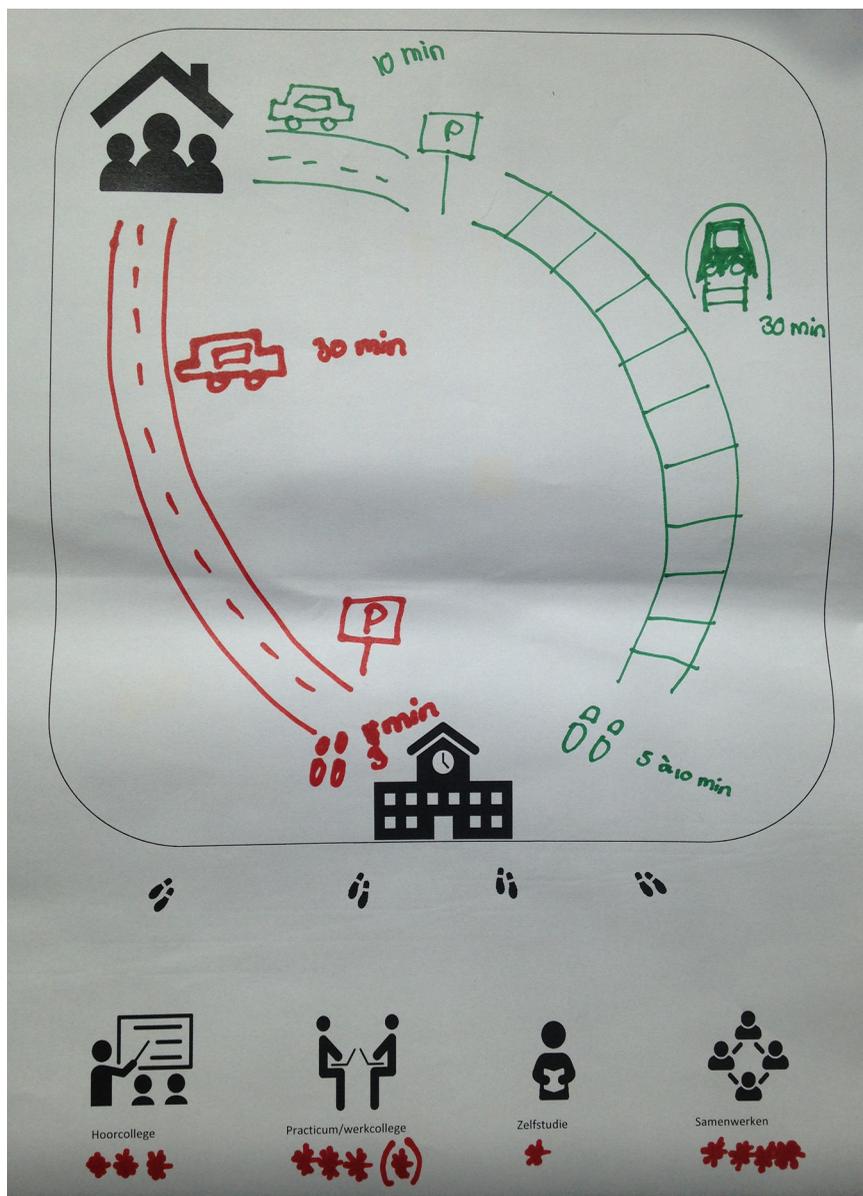


Figure A2.
Drawing of
participant



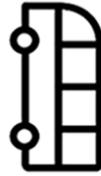
Bicycle



Train station



Car



Bus



Walk



Carpool



Parking

Figure A3.
Icons for drawing
