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Optimizing a Public Transportation System based on Young Drivers' Attitudes and the Theory of Planned Behavior Factors

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Abstract

In Duluth, the largest demographic living in poverty is 18-24-year-olds. Drivers within this age range are also over-represented in crash statistics in the state of Minnesota. Further, owning and operating a personal vehicle can be costly, especially for young drivers with no stable or high income. Sustainable commute modes include commuting with low impact on the environment, transporting more than one passenger, or replacing fossil fuels with green energy. Behavioral changes are necessary to get the maximum benefits from sustainable commuting such as encouraging the use of alternative modes of transportation like the public transportation system.

Although the benefits of sustainable commuting include saving money, being eco-friendly, and having a positive social impact on society, a survey of 370 18-24-year-old drivers found that 46% choose their vehicle as their primary commuting option. This research explores the perception of young drivers in Duluth toward the use of public transportation. Based on the factors from the Theory of Planned Behavior (TPB), the study shows that even if their attitude was favorable and there existed a strong social structure, within Duluth, toward using the bus, control factors exist that impede their decision to use the bus. If these factors are not addressed, then ridership will continue to be low.

Keywords: travel behavior; young drivers; sustainable commuting; public transportation

Abbreviations

DECC - Duluth Entertainment Convention Center DTA - Duluth Transit Authority.
LLO - Large Lakes Observatory.
NRRI - National Resources Research Institute SDT - Self-Determination Theory.
TPB - Theory of Planned Behavior UMD - University of Minnesota Duluth.

Introduction

Many universities encourage students, faculty, and staff members to use alternative modes of transportation such as public transportation, car sharing, or bicycles when commuting to and from campus. At the University of Minnesota Duluth (UMD), students are given a free year-round bus pass to encourage public transportation. However, the mid-sized cities like Duluth, encouraging more public transportation becomes challenging since road congestion is not a significant problem and the long Winter months make owning a personal vehicle more attractive. This study attempts to understand the attitude of university students toward the local public transportation system to suggest improvements to the current public transportation system.

Sustainability implies balancing current and future economic, social, and environmental qualities thus meeting the needs of the present without comprising the ability of future generations to meet their own needs (Commission mondiale sur l'environnement et le développement 1991). Human activity has raised the Carbon Dioxide (CO_2) levels by 50% in less than 200 years such that the levels are their highest in 650,000 years at 420 parts per million (NASA's Jet Propulsion Laboratory 2023). Since CO_2 in the atmosphere warms the planet, causing climate change, reducing their levels and motivating people to contribute toward lowering these levels is imperative.

In the United States (U.S.), 79% of Greenhouse Gas (GHG) emissions are CO_2 with the leading contributor of GHG emissions being Transportation (27%) followed by Industry (24%) (United States Environmental Protection Agency 2022). In the state of Minnesota (MN), more than 70% of emissions from the transportation sector come from light-duty trucks, passenger vehicles, and medium to heavy-duty trucks (Claflin and Steinwand 2019). Although GHG emissions from transportation have decreased by 8% since 2005, it still accounts for about one-quarter of the GHG emissions in Minnesota. Encouraging alternative modes of transportation including car-sharing, public transportation, bicycles, and walking can help reduce GHG emissions. Motivating people toward alternative modes of transportation involves understanding why they do not use these forms of transportation. Furthermore, motivating young drivers to reduce their car use may lead to long-term habits in seriously considering alternative modes of transportation.

In MN, 18-24-year-old drivers are the most represented in fatal crash statistics and form the demographic with the highest poverty rate (Deloitte., Datawheel, and Hidalgo 2020). Forty-two percent (42%) of millennials are willing to use car-sharing, car-pooling, or similar services if they are readily available or convenient. Compared to 35% of other generations, 53% of millennials say the cost of owning a car is out of reach for them, including gas, insurance, and parking. In addition to the reduction in personal expenses, reducing the number of vehicles on roads will save money by heading off the need to spend money on highway expansion, which currently costs anywhere between $2 million to $6 million per mile depending on location, construction codes, and size (Elswick 2016). Doing so will also ease congestion, reduce emissions of pollutants that harm public health and alter the climate, and save lives through avoided vehicle crashes along with increased health benefits (Steg and Gifford 2005; Circella et al. 2016; Ohio University 2021). The research question then becomes how to motivate young drivers, in a small to medium rural city like Duluth, to reduce their dependency on personal vehicles.

Two theories that warrant discussion in this context are the Self-Determination Theory (SDT) and the Theory of Planned Behavior (TPB). The SDT is a broad framework for human motivation. It proposes that the degree to which any of the three psychological needs - autonomy, competence, and relatedness, is unsupported or thwarted will negatively impact the individual's intrinsic motivation toward an activity (E. L. Deci and Ryan 1985; E. Deci and Ryan 2000; Ryan and Deci 2000). When investigating an individual's intention to engage in a type of behavior, the theory of planned behavior (TPB) states that the determinants of intention are: (1) attitude toward the behavior, (2) perceived social pressure, and (3) perceived behavioral control (Ajzen 2020; Sansom 2022). Relevant to this work where the desired behavior is the use of public transportation as the primary mode of commuting, the determinants can be defined as follows. Attitude towards sustainable transportation generally, and toward the use of the existing public transportation system in Duluth.

Subjective norms include both the perceived expectation of others and how much the individual values those expectations. Perceived behavioral control is how able an individual feels to perform a specific behavior. Thus, it includes both self-efficacy with the use of public transportation and external factors that would support the individual's intention toward using public transportation.

The major barrier for students to use public transportation include long travel time, safety, accessibility to the bus stop, distance, and insufficient knowledge of the service (Schneider and Hu 2015). In a study conducted at the University of Calabria in southern Italy, walking distance to the bus stop, frequency, reliability, bus stop facilities, bus crowding, cleanliness, fare, information, and transit personnel attitude were important attributes to the service quality (Eboli and Mazzulla 2008).

Bus service quality is defined as "how well the transit service fulfills its customers' demand" (Shaaban and Kim 2016). Improving bus service quality would impact customers' choice of mode of transportation and thus understanding the customers' attitude toward public transportation becomes important. Shaaban and Kim 2016 found, using structural equation models (SEM), that university students in Qatar's mode of transportation was positively influenced by service at bus stops, service of busses, and service of drivers. Based on survey responses, bus shelters must be designed keeping in mind factors such as weather conditions, the number of passengers boarding the bus and frequency of bus service, travel time should be a priority for improvement, and providing real-time messages about the location of the bus, for passengers waiting, should help increase the number of bus users.

Between 2001 and 2009, the average number of miles driven by 16 to 34-year-olds dropped by 23 percent, because of young people taking fewer trips, shorter trips, and a larger share of trips by modes other than driving (Circella et al. 2016; Ohio University 2021). However, this is not the case in Duluth even when personal costs are high. Understanding the travel behavior of young drivers in Duluth and attitudes toward the use of transportation should be an important goal for the Duluth Transit Authority (DTA) to increase students' use of public transportation. Furthermore, facilitating non-auto infrastructure will support evolving travel preferences as observed in Boulder, Colorado (Henao et al. 2015).

In the region of Waterloo, Canada, the *iXpress* was responsible for the reduction of 1.5 million kilometers of personal automobile trips per year, with an associated reduction of 500 tonnes of GHG emissions. The goals in developing the *iXpress* were more reliable service and travel times compared to travel times using a personal vehicle. The use of advanced technologies enhanced the travel experience by improving pre-trip planning via a web-based trip planner, improving transit rider knowledge using real-time traveler information panels that display the expected arrival time of the next bus and the speed, comfort, and reliability of the service using transit signal priority. This work will show, using survey responses (quantitative and qualitative), that features such as those of the *iXpress* are required to support young drivers' behavioral intentions toward using public transportation and, thus, increase ridership with the DTA.

Materials and Methods

Duluth and the DTA

Located south of the Iron Range and the Boundary Waters Canoe Area Wilderness, Duluth is a port city on Lake Superior in Minnesota with a population of 86,372 (2021). It has a humid continental climate making winters cold. Due to the cooling effect of the lake, summers are warm with cool nights. The DTA serves the Duluth, Superior, Proctor, and Hermantown areas. Duluth has six parks on Lake Superior and hosts a 39-mile segment of the Superior Hiking Trail which is also part of the North Country National Scenic Trail - the nation's longest hiking trail. Among the University of Minnesota's research units are the Natural Resources Research Institute (NRRI) and the Large Lakes Observatory (LLO). The NRRI was established by the Minnesota legislature in 1983 as an applied science and engineering research organization to foster the economic development of Minnesota's natural resources in an environmentally sound manner (Natural Resources Research Institute 2023). The LLO is an academic and research unit within the Swenson College of Science and Engineering at the University of Minnesota Duluth (UMD) that researches how to support the sustainability of the large lakes of Earth (Large Lakes Observatory 2023). Due to the region's research organizations, proximity to Lake Superior, high abundance of hiking trails, and Winter sports, it is assumed that the general attitude, in Duluth, toward environmentalism and sustainability in Duluth is high.

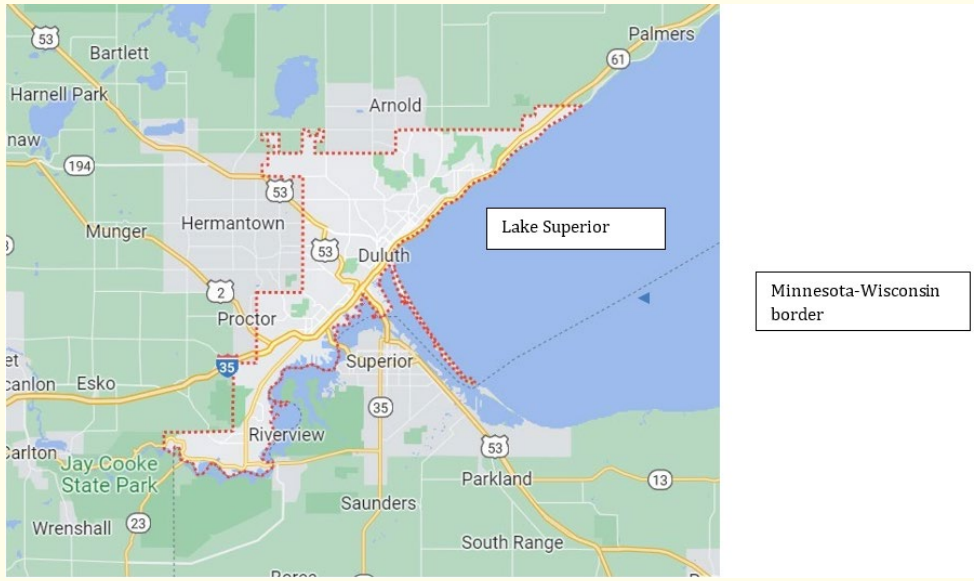

Figure 1: Map of Duluth showing the Minnesota/Wisconsin boundary.

Study Methodology

An online survey, delivered via Google forms, was used to collect the data from students (18-24 years old) at UMD. An email was sent to all academic departments at UMD to recruit responses for the survey. Respondents were entered into a draw to win one of 10 possible $20 gift cards. The survey consisted of 27 multiple-choice questions that captured popular destinations, popular bus routes, and reasons why students choose a personal vehicle over the public transportation system. When this study was conducted, UMD had a total enrolment of 11,040 students. Using a 95% confidence level and a 5% margin of error, the ideal sample size would be 372. Responses were received from 370 students with 319 complete responses. The 319 complete responses satisfy the sample size recruitment under a 90% confidence level assumption. At the end of the survey, there was one open-ended question for participants to offer any additional comments regarding their perceived barriers toward using the Duluth Transit Authority (DTA). These comments are presented in Appendix A exactly as they were written by participants without any changes to grammar or spelling. Data about the DTA including travel times to popular destinations, ridership statistics, and route maps were obtained from the DTA's website and reports published online.

Results and Discussion

A $16.00 transportation sustainability fee is automatically deducted from UMD undergraduate students, each semester they enroll in six or more credits. This fee allows students to participate in the U-Pass program with the DTA which facilitates unlimited rides on all DTA buses. Based on data collected from the sustainability office, 3,964 (35.91%) students rode the bus at least once during the semester; 2,262 (20.49%) rode the bus more than 10 times, and 1,832 (16.59%) students rode the bus more than 21 times. Based on the cost of one trip using the DTA, students would have to ride the bus 22 times to get the full value of the $16 sustainability fee.

Among the 319 responses, 233 participants (73.04%) own a personal vehicle. The primary form of commuting for 46% of respondents was their vehicle followed by 24% that chose the bus, 17% walking or rode their bike, and 10% carpooled. From Figure 2, 42% of respondents say they never use the bus. Among these respondents, the most cited reason for not using the bus more frequently is "Inconvenience of the Bus Schedule" followed by "Wait Time". For daily riders, "Inconvenience of the Bus Schedule" was also the high-

est cited reason (~50%) for not using the bus more often. In terms of inconvenience, it is unclear, from the quantitative results, what this means from the perspective of the participant. For public transportation, this might refer to longer travel times, long wait times, or a loss of autonomy by having to adjust personal schedules according to bus schedules. Among the TPB factors of attitude, perceived societal norm, and perceived behavioral control, inconvenience falls in the category of perceived behavioral control. A rider would have to adjust their schedule based on the schedule of the public transportation system. There is also the increased commute time. Although a rider may be part of a community and may themself also have a strong interest in sustainability, these inconveniences will significantly influence their behavioral intention toward using a public transportation system like the DTA.

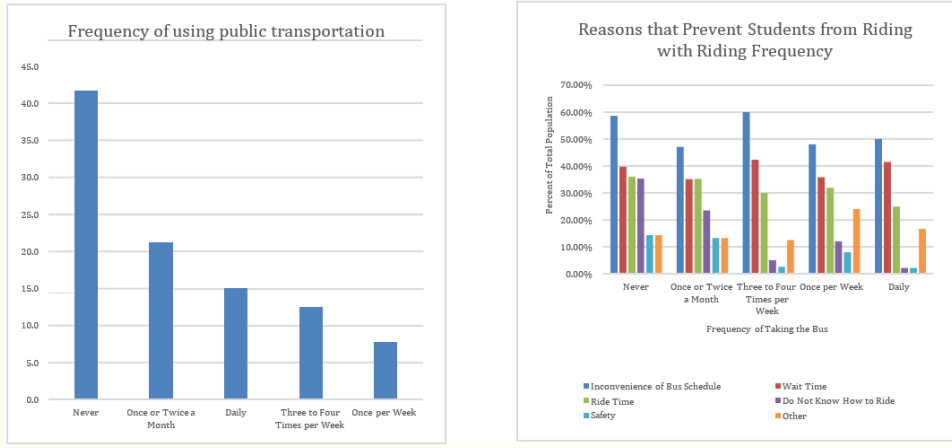

Figure 2: Frequency of using public transportation and reasons that prevent more frequent use of public transportation.

The inconvenience of the Bus Schedule - Ride Time and Wait Time

From Figure 3, among bus riders, the top three destinations, in descending order, are School (UMD Campus), Downtown Duluth, and Target and the popular routes are 13, 11, and 23. From the perspective of the DTA, the top-performing routes are 7, 23, 6, 10H, and 13 (Connectics Transportation Group 2021). These routes provide more direct service to key areas including Downtown Duluth, UMD, and the Miller Hill Mall. Route 23 is a UMD circulator developed by the DTA to transport students from their homes to the UMD campus. For the DTA, Downtown Duluth and the UMD campus are areas with high ridership. Therefore, designing routes to serve these areas would be economically feasible from their perspective. Downtown Duluth contains over 23,000 jobs, and nearly 7,000 residents and is the location of the DTA hub. Total ridership is approximately 31% (6,250 total activity) of the DTA's daily weekday ridership activity. The UMD campus has the second-highest daily weekday ridership at 18% (3,600 total activity). This area contains over 10,000 residents, and 4,500 jobs, and is served by eight of the DTA's routes (Connectics Transportation Group 2021).

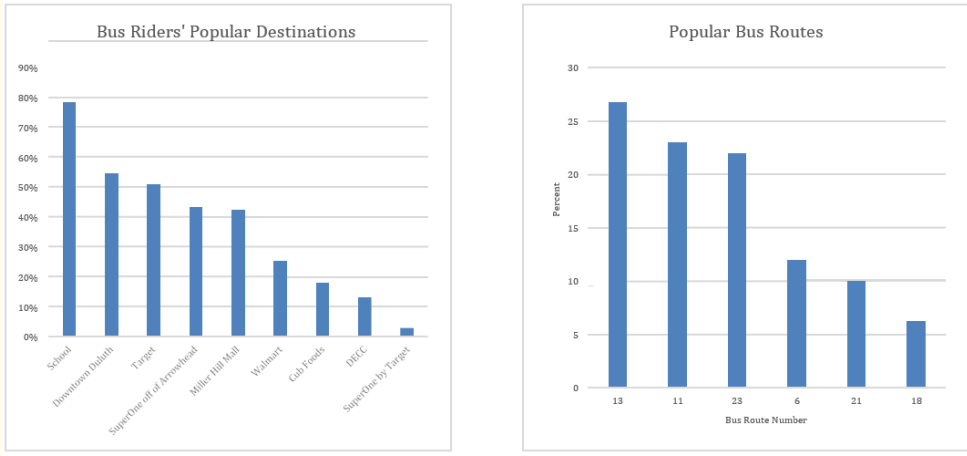

Figure 3: Popular Destinations and popular bus routes.

Figure 4 shows maps from the DTA's website showing routes 13, 6, 7, and 23. All routes travel through the UMD campus and cover the surrounding residential areas. Some points of interest are circled on the maps. Figure 5 shows a map of the Miller Hill Mall area with other points of interest circled including Target, Walmart, and Cub Foods. The routes shown in Figure 4 can pick up students from the surrounding residential areas are carry them to campus and the SuperOne on Arrowhead Road so the road would be convenient. However, traveling to the other points of interest in the Miller Hill Mall area would require transferring to another bus. Investigation of the commuting times to points of interest, as shown in Table 1, commuting by bus is, on average, 23 minutes longer; sometimes more than twice the commuting time when using a car. Compared to using a personal vehicle, traveling to Downtown Duluth is 14 minutes slower than using a personal vehicle, to Miller Hill Mall is 31 minutes slower, and to Target, is 32 minutes slower. For Miller Hill Mall and Target, using the bus is two times slower than a personal vehicle and this does not factor in the potential wait time. Although routes 13, 11, and 6 facilitate travel to the other points of interest, a large portion of respondents still do not use the bus. The longer commute time along with transferring to another bus coupled with cold weather would make the loss of autonomy felt more due to the confusion and perceived hassle.

	Travel Time from UMD Bus Hub to Popular Destinations (Minutes)						
Mode of Transportation	***Downtown Duluth***	***Miller Hill Mall***	***Target***	***SuperOne (Arrowhead)***	***Walmart***	***Cub Foods***	***DECC Arena***
Car	10	15	15	6	16	14	16
Bus	24	46	47	12	68	35	24
Difference	-14	-31	-32	-6	-52	-21	-8

Table 1: Travel time comparison between car and fastest bus route.

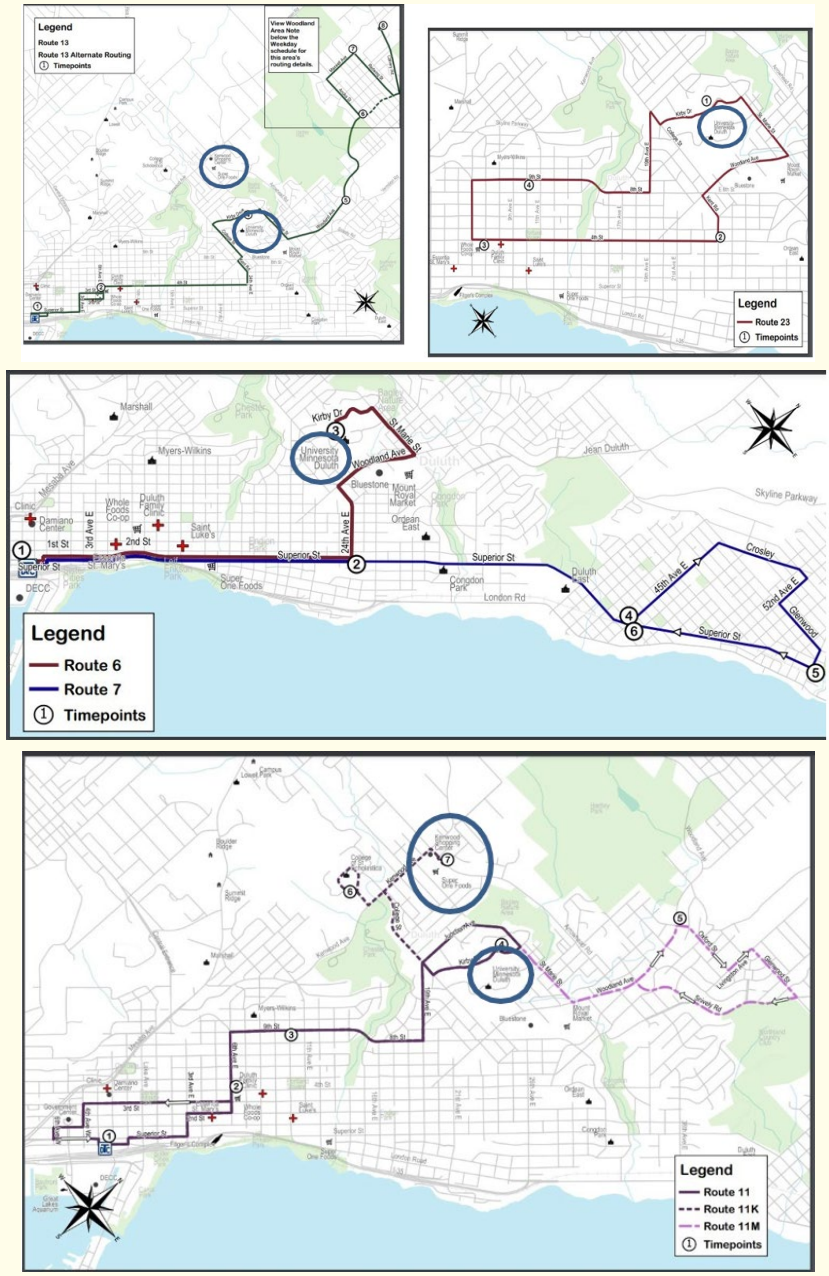

Figure 4: Bus Routes for 13, 23, 6, 7, and 11.

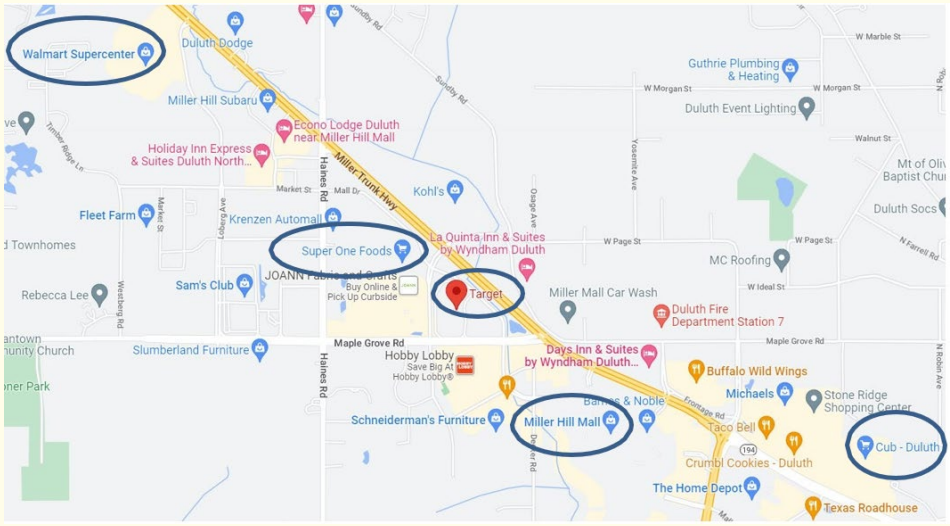

Figure 5: Map showing the locations of Target, Miller Hill Mall, SuperOne, Cub, and Walmart.

Wait time was the second most answered reason for preventing students from taking the bus more often with > 40% for daily riders. The survey asked how the students would rate the current bus schedule on a 1-5 scale (1-Bad and 5- Excellent). Forty-two percent (42%) of respondents gave the current bus schedule a rating of 4, 33% a rating of 3, and 15% a rating of 5, leading to an average rating of 3.6.

Appendix A presents a table with all the comments received from the survey. Comments 9, 10, 30, and 43 illustrate the point of long commute times and infrequent inter-arrival times. These comments reiterate the information presented in Table 1. When this survey was distributed, Route 21 provided a route to the mall from the UMD campus with a travel time of approximately 25 minutes. The comments show a lack of knowledge about this route. This route has since been canceled due to low ridership. Another pitfall of that route was that it ran during the week which was, potentially, not feasible for students who are less likely to travel to the mall during the week. In the next section, some comments will be presented that seem to indicate that students were unaware of the existence of this route.

Ignorance of Riding the Bus

The third most picked prevention reason was that students did not know how to ride the bus with 21.63% of students choosing it. Based on qualitative responses from the survey, this reason encompasses a broad range of answers such as: not knowing about the U-Pass program (Comment 46), and not knowing the schedule or what bus to take (Comments 40 and 51). Comments 8 and 43 give additional evidence of the ignorance about Route 21. If students learned how to ride the bus and read the schedules, the misconception that the bus is difficult to ride would be counteracted. This lack of knowledge can potentially lead many students to shy away from using the bus. From the SDT, this shows a lack of support in building users' competence in using the bus. To increase their behavioral intention toward using the bus, this is one avenue to be explored: how to help riders develop self-efficacy by teaching them how to use the bus.

Another respondent suggested the following

"I think it would be a really great idea, although possibly not feasible, to have a phone app that shows where your bus currently is to cut down on waiting times or route inconsistencies to increase the number of people who are willing to ride the bus, especially during cold days".

The DTA has since developed an app to assist with route planning and real-time tracking. However, this requires the ridership to have pre-existing knowledge about the app to access it from their phone. The *iXpress* counteracted this issue by having real-time tracking at the stations.

Perspectives relative to the TPB factors

The three factors of behavioral intent - attitude, subjective norm, and perceived behavioral control - are modeled using equations (1), (2), and (3), respectively. The TPB postulates that a favorable attitude and a supportive subjective norm motivate the individual to engage in the desired behavior. However, the intention is strong only when the individual perceives a high behavioral control (Ajzen 2020).

In this work, the behavior of interest is using the bus. The attitude toward using the bus is a function of beliefs regarding the behavior's likely consequences including: (1) the bus is environmentally friendly, (2) allows the rider to save money, and (3) is almost as convenient as using a personal vehicle. From equation (1), a person's attitude toward the behavior is directly proportional to the individual's subjective evaluation (e) of each belief (b).

$$ATT \propto \sum b_i e_i \quad (1)$$

Although Duluth is an active outdoor community with a positive attitude toward environmentalism and sustainability, survey responses suggest that the attitude toward public transportation is not favorable. Among the three beliefs described above, convenience has a low evaluation from the perspective of the survey participants.

Subjective norm (SN) is the perceived social pressure to engage in the behavior. Perceived social pressure is dependent on injunctive and descriptive beliefs. An injunctive belief is an expectation that the people that influence the behavioral intention of the individual approve or disapprove of performing the behavior under consideration. Descriptive beliefs are whether important others themselves perform the behavior. From equation (2), SN is directly proportional to the belief with respect to a social referent (n) multiplied by the referent's importance to the individual (s).

$$SN \propto \sum n_i s_i \quad (2)$$

From the survey results, the university (which might be a distant social referent) developed the sustainability fee, in collaboration with the DTA, to encourage bus ridership. Among survey participants, 73% own a personal vehicle and 42% never take the bus. This provides some indication that the individual's social referents - family and friends - support the use of a personal vehicle instead of the bus. Therefore, the SN might be low.

Finally, perceived behavioral control (PCB) is concerned with the presence of factors that facilitate or impede the performance of the behavior. These factors include required skills and abilities, availability of time and money, cooperation from other people, etc. From equation (3), PCB is directly proportional to the sum of products of control belief (c) multiplied by its perceived power (p).

$$PBC \propto \sum c_i p_i \quad (3)$$

Assessing PCB requires a knowledge about various internal and external factors that are needed for 18-24 year-olds to use the bus as well as a way to assess the extent to which they can obtain the resources to overcome potential barriers. Students already contribute to the sustainability fee as part of their tuition. Therefore, money is not an impeding factor. Weather might be an impeding factor since waiting outside for the bus during the Winter months is not comfortable. The DTA might consider installing heaters in their bus sheds which would overcome this barrier. Another impeding factor is the lack of knowledge of how to use the bus and schedules. An on-campus training session might help with self-efficacy.

Conclusion

This study explored the attitude of 18 to 25-year-old students toward the existing public transportation in Duluth, MN based on the TPB factors. The TPB postulates that an individual's intention toward a desired behavior is influenced by their attitude toward the behavior, subjective norms, and perceived behavioral control. In addition to a low attitude toward using the bus and the lack of a supportive subjective norm, perceived behavioral control is low. Control factors exist that impede students' intention to use the bus including long wait and commute time, and a lack of educational mechanisms to support their self-efficacy in using the bus.

The most cited reason why students do not use the bus more often is the "Inconvenience of the Bus Schedule". Although there are routes designed to carry students from their homes in the residential areas surrounding campus to campus, commuting to other popular areas of interest would require transferring to another bus from downtown Duluth. Participants also cited "Wait Time" and "Ride Time" as reasons why they do not use the bus more often preferring arrival frequencies of once every 15 minutes instead of once every 30 minutes. Ride times using the bus to popular destinations from campus were, on average, 23 minutes longer than using a personal vehicle. Other issues included a lack of knowledge of using the bus and the cold winters of Duluth. To encourage increased ridership, riders must be assisted in developing their self-efficacy in using the bus by teaching them how to use the bus in terms of looking up schedules and planning trips. This might be in the form of flyers posted around campus or a workshop, periodically, to teach new students how to use the bus. Future work might investigate the impact of these strategies on improving young drivers' ridership.

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Appendix

Comment No.	*What prevents youfrom riding the busmore often?*	*If you have any additional thoughts or comments about thecurrent commuting state in Duluth please leave them here.*
1	Wait Time; Ride Time; Inconvenience of current bus schedule	A lot of times I drive to school in the winter because it's really cold andI end up having to pay for the pay lot which is really annoying
2	Ride Time	Have been Times my vehicle was down and would have taken the bus, but didn't want to look up the schedule and walk to the stop. Assumed that the bus wouldn't be coming through right at that particular time aswell.
3	Inconvenience of current bus schedule	I drive primarily to ice rinks and have limited windows of time to getthere.
4	Ride Time; Do not know how to ride; Cold weather	Commute 90 miles/day. Spend almost as much time stuck in traffic onLondon road southbound as I do from Two Harbors to Duluth.
5	I'm close enough to campus (~2 blocks away) that riding the bus would be redundant	I only ride the bus because I can't afford a parking pass. Otherwise mycar runs on my schedule and is thus much more convenient and comfortable
6	other rides available	They should have a bus that goes from Superior to umd
7	Wait Time; Ride Time; Inconvenience of current bus schedule	Speed limits too low
8	Inconvenience of current bus schedule	I wish that there were more buses that only made trips to target or themall then back.
9	Wait Time; Ride Time; Inconvenience of current bus schedule	One bus to downtown to watch a movie and then back usually takes around 4 hours in total, meaning I spend as much time on/waiting forbuses as i do watching the movie.
10	Ride Time	Its cold, waiting for the bus outside sucks. Might as well walk when you're less than a mile from campus.
11	I don't travel often offcampus	Having a car and having to on street park is a huge hassle especially in winter. roads are rough and with snowbanks piling up they are one way only. Alternate street parking is not worth the hassle either because no one follows the rules and on Sundays its impossible to get through some roads becuade (sic) of cars parked on both sides of the street.It also makes no sense to have alt side parking in summer when they don't (sic) plow.

12	Inconvenience of current bus schedule	Some of the drivers get risky
13	Safety; Inconvenience of current bus schedule	I wish the duluth city would fix the roads and make bus lanes for the bus. feels like commute time is slower because of the traffic and small lanes.
14	Inconvenience of current bus schedule	Later after 5 seems much harder to catch buses going to downtown having to wait longer
15	Inconvenience of current bus schedule	I used to live in Chicago and only used Public transportation. Now it takes longer for me to ride the bus and I have to leave earlier. Since thebus only leaves every half hour, I can leave my house later if I walk or bike. Or if I'm not going to campus I typically drive because I have to wait so long between busses and this just adds another layer of planning and complexity to my already very busy schedule. However, Ihave enjoyed using public transportation in the past and would do so ifmore options were available.
16	Don't need to	I really need to start taking the bus, unfortunately it is usually pretty inconvenient with my current busy schedule. I need to frequently leavecampus during the day, but I would love to start taking the bus on dayswhere my schedule allows.
17	Inconvenience of current bus schedule; Do not know how to ride	I think the bus options in Duluth are a great asset and I very much appreciate them!
18	Wait Time; Ride Time; Inconvenienceof current bus schedule; Do not know how to ride	If the university pays for our bus pass but ppl don't (sic) use it. Why not setup an in campus uber/Lyft style service. This would give students money and convenience!
19	I ride it all the time.	I think it would be a really great idea, although possibly not feasible, tohave an phone app that shows where your bus currently is to cut downon waiting times or route inconsistencies to increase the number of people who are willing to ride the bus, especially during cold days.
20	Wait Time; Inconvenience of current bus schedule	I tried to state it during the response, I am not currently a student but Iwas and answered as I would have while attending. I commuted for three years while I attended UMD. I hope the information was useful!
21	Safety; Do not knowhow to ride	I drive to school everyday because I'm often on campus from 8am to 10:30pm. There's not many buses that go from my house to campus that early or that late at night.
22	Wait Time; Inconvenience of current bus schedule	Have more umd traveling stops near the mall area and at earlier timesin the morning.
23	Inconvenience of current bus schedule;Do not know how to ride	I prefer biking and do so when there is not snow on the streets. I wouldencourage maintenance of bike lanes in the winter when they are generally covered in snow or people park over them.
24	Ride Time; Do notknow how to ride	Buses should run later on weekends

25	Wait Time; Ride Time; Inconvenience of current bus schedule	Route 6 running on Sunday
26	Ride Time; Routes do not go close to destination	buses should run later
27	Inconvenience of current bus schedule	Duluth needs more bus routes at more convenient times.
28	Wait Time; Inconvenience of current bus schedule	More locations for the bus to stop at if the stop cord is pulled. Sometimes have to go past areas where I could get out closer to my destination
29	Safety	I live in Lakeside and the options for riding the bus from this neighborhood are very slim. If there was a more frequent option it would make taking the bus a lot easier.
30	Wait Time; Ride Time; Inconvenienceof current bus schedule	It would be more convenient if the buses came by every 15 minutes rather than every 30 minutes.
31	Inconvenience of current bus schedule;Do not know how to ride	Wait time for buses is often 20-30 minutes (I could walk home in thattime) and routes that go to the same general places often all have the same stop times. Staggering the stop times would greatly improve thescheduling issue.
32	Wait Time	Please add a route to NRRI in Hermantown!
33	Wait Time; Ride Time; Safety; Do notknow how to ride	Buses should be run more frequently and to more places around Duluth to make public transportation easier in Duluth.
34	Ride Time	Need more routes that go to campus that service more areas of Duluth
35	Wait Time; Ride Time; Inconvenienceof current bus schedule	Student drunk bus from the bars would be good
36	Lack of need	I like the bus system and appreciate having it available (sic)
37	Inconvenience of current bus schedule	Might be helpful if there was time staggering of the East-bound routes.
38	Inconvenience of current bus schedule; Do not know how to ride	I'd like to ride the bus more if more buses were available more often(meaning less wait time and less worry about missing the last bus)
39	Inconvenience of current bus schedule	There was a day that the bus was more than 40 minutes late, with devices saying it was around two minutes away the entire time. If it'sgoing to be that late, I'd appreciate a message saying to find another means of transportation.
40	Inconvenience of current bus schedule	Currently, the bus system seems too confusing. If I take one bus somewhere, I have to take the exact same bus back otherwise I get lost.Also, many of the routes seem very long so a trip that shouldn't take more than 2 hours takes almost 4.
41	Wait Time; Ride Time; Inconvenienceof current bus schedule; Do not know how to ride	The safety isn't with the bus itself it's more of a weather thing and roads. Just wanted to clarify
42	Inconvenience of current bus schedule	There should be more walking bridges or sunken roads.

43	Inconvenience of current bus schedule	It takes a really long time to get from miller hill mall and back,especially on the weekends.
44	Wait Time; Ride Time; Safety; Inconvenience of current bus schedule	As someone who frequently goes to places along London Road by 21stAvenue East, it would be nice if there was a direct bus line that went down to London Road form UMD.
45	Inconvenience of current bus schedule; Doesn't go close to where I work, I would have to walk at least 10 mins and I don't have that time in my day.	Need a way to get to other satellite campus locations (specifically NRRI).
46	Don't need to take thebus anywhere	Many students are unaware that their u-card works as a free bus pass.
47	Wait Time; Ride Time; Safety; Inconvenience of current bus schedule	Duluth transportation is pretty solid. Through biggest issue is the quality of the roads aweful!
48	Inconvenience of current bus schedule	The schedule is confusing due to the fact that the bus numbers do notmatch the schedule numbers and times most of the time
49	Wait Time; Inconvenience of current bus schedule	I live in Superior and commute to UMD. The bus takes over a hour torun the route from East end to UMD.
50	Inconvenience of current bus schedule; Do not know how to ride; I dislike riding with people I don't know	The current schedules for some buses that transit to UMD can be inconvenient for student schedules. For example, if I have a class at 8am, the bus I take (route 6) usually arrives at UMD around 7:50-7:55am, my only other option to arrive on time is to take the earlier bus which will get me to campus almost an hour early (7:10ish).
51	Wait Time	I'm very confused on how read schedules/ get around to the correct destinations
52	Wait Time; Ride Time; Inconvenience of current bus schedule	Roads aren't good and need fixing
53	Wait Time; Ride Time; Safety; Inconvenience of current bus schedule; Inconvenient route to the airport from campus and hard to move items like groceries on the bus	The parking in the green lots is awful. I have gotten stuck in a parking spot 3 times in a week and had to get pushed out. I even have an SUV! Ithink plowing needs to be a bigger priority and possibly add in parkingstructures. That would keep people closer to where they need to be and not have to walk as far in the awful cold Duluth brings.
54	Ride Time; Inconvenience of current bus schedule	It would be nice to have a direct line to places that are campus affiliated like NRRI and LLO but I don't know if that is a DTA thing of aUMD thing.
55	Wait Time	More buses later at night so that I'm not stuck waiting for a full hour if I miss a bus
56	Do not know how toride	Reinforcing the clear sidewalk laws. Snow removal from pick up areas.

57	Ride Time	I often bike during the summer and ride the bus during the winter. I appreciate the bus schedule by my house runs every ~30 min. However, it takes me ~45 minutes to get from my house to downtown. Luckily, my job is flexible which allows me to work with the bus schedule, but it does eat up an hour and half of my time daily. I wish there was a bus route that would go to Woodland, but skip UMD and go straight downtown. I feel that it would cut down on quite a bit of time, though I know it's most likely not possible. Overall, I appreciate the reliability of the bus, especially with the amount of snow we got this year. It's typically on-time if not a little early. Thanks!

Appendix A: Comments received from survey participants.