Article

University Bus Services: Responding to Students’ Travel Demands?

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Abstract: University bus services provide fixed-route public transport for students to and from large universities. They are relatively affordable and resource-efficient, but must compete against private cars and taxis which tend to be more convenient and flexible than University bus services. Many students, particularly those with lower incomes, depend on them. University administrators must understand how to improve University bus service in order to treat this group fairly. The main contribution of this paper is to examine how University bus service can help achieve social equity and sustainability goals. It investigates this by reporting the results of a survey of 303 students at Shahid Bahonar University of Kerman in Iran concerning their travel demands and University bus service utilization. Grounded theory and structural equation modeling is used to analyze the daily commute preferences of university students influenced by their characteristics, fleet condition, fares, station condition, and time factors. This study identifies various steps that the university administration can take to make University bus service more efficient and attractive, such as updating the bus fleet, improving stations, increasing security, and improving pedestrian access to stations. Survey respondents reported the highest satisfaction levels with fare levels, the security in buses, and waiting times. Women reported feeling discriminated against in their daily commutes. Poor-quality University bus service contributes to a negative feedback loop that increases automobile use and reduces university travel sustainability.

Keywords: transportation equity; university bus; structural equation modeling; satisfaction

1. Introduction

Many large universities strive to provide sustainable (affordable, safe, attractive, and resource-efficient) transportation for students [1–4]. This can help reduce costs to students and their families, traffic and parking congestion, air pollution, and other undesirable traffic impacts.

To help achieve sustainability goals, universities should encourage public transit [5,6] and active transportation (walking and cycling) [7] over private automobile travel. There are many negative consequences associated with using private cars, including fuel consumption, traffic congestion, air pollution, delay, noise pollution, and more [2,5,8–13]. These impacts threaten the economic and environmental sustainability of our planet.

Public transportation is an affordable, inclusive, and resource-efficient transport mode [14]. Students are primarily dependent on transit to get to school, according to a study in Canada [15]. Many students, particularly those with low incomes, rely on public transport [16]. However, transit must compete against private automobiles and taxi, which tend to provide more convenience and comfort. To satisfy users’ need and attract non-captive users away from private transport, public transit must offer high-quality service [17]. To keep customers loyal and attract new ones, public transit needs to improve its service quality in a way that meets their needs [18]. The satisfaction and service quality of public transportation systems are two main factors that promote the loyalty of citizens [19].
Inadequate public transit can cause financial stress, poor health, and a decrease in quality of life for physically and economically disadvantaged groups [20–23]. Thus, improving public transportation’s benefits for low-income and socially disadvantaged people is essential for achieving sustainability goals [24–27]. Compared to other members of society, students are more likely to use public transportation [28,29]. Consequently, a large group of people is less likely to be discriminated against or excluded from social activities [30]. According to a study in Canada, discounted transit passes influence youth commute decisions more than active transport or private cars [31]. In addition, it has been suggested that hourly parking tariffs and subsidies for bus services are two important policies to promote bus use among students [32].

As a result of the determination of public transportation equity scores [33], policymakers, service providers, and urban planners can decide the various aspects of a project during the planning stage [34]. Different definitions exist for equity. Equal distribution of resources (simple equality), taking into account differences among social groups when distributing resources (formal equality), distributing resources according to people’s incomes and payments (proportional equality, e.g., Smith), maximizing society’s welfare or reducing poverty (utilitarian theory, e.g., Pareto and al-Sadr), distributing resources by taking into account people’s basic needs, especially those of disadvantaged and low-income groups (e.g., Marx, Rawls, sufficientarian theory, prioritarianism) [35]. The equity definition in this article is closer to Marx’s and Rawls’ views, sufficientarian theory, and prioritarian theory.

Equity in transportation is influenced by socioeconomic demographic characteristics, transport service quality, and built environment [16]. As a result, affordable and efficient public transportation helps achieve a university’s social sustainability and social equity goals by ensuring that all students, including those with disabilities and low incomes, have convenient and safe access to campuses [26,36–38].

2. Shahid Bahonar University Bus Services (UBS)

This study examines the UBS at Shahid Bahonar University of Kerman in Iran. Buses run from Saturday to Thursday from 6:50 a.m. to 6:50 p.m., approximately every hour, depending on the time of classes. A route from the city center to the university is about 9 km, and a route from the Technical Faculty to the university is about 12 km. There are usually one to four buses assigned to each route depending on the time of day and day of the week. The UBS of Shahid Bahonar University of Kerman travels from the city center to the university and vice versa. During the workday, they are available from 6:30 until 21:00. Buses arrive every 30 min at the station. Buses can carry up to 40 passengers. There is gender separation on buses. Most UBS buses are more than 20 years old, although some newer buses were recently added that have better amenities. For instance, older buses have hard fiberglass seats, while the new buses have comfortable seats with fabric cushions, in addition to better heating and cooling systems. Bus stations have few amenities. They lack sufficient lighting, chairs and shading, and station signs, and the station’s locations near a major highway poses a safety and security concern. Security is an important issue in each system [39,40], especially for female passengers of public transportation systems, whose security relates to fear of violence and harassment [41–47].

3. Public Transportation Demands

“Travel demand” refers to how and how much people travel, and the factors that affect this, including demographic factors, such as age, employment and income; geographic factors, such as where they live, study and work; and transportation system factors, such as the relative price, comfort, and speed of various travel modes (walking, bicycling, public transit, taxi, and automobile).

To attract non-captive users and satisfy captive users, it is essential to identify factors that influence their decisions to use public transportation. By doing so, the university transportation system can encourage more sustainable travel. Table 1 summarizes the
variables that affect the decision of students to use public transportation for daily commutes to universities.

Table 1. Summary of research papers in relation to using UBS.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Case Study</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting time, fare, and safety</td>
<td>SBUK in Kerman, Iran</td>
<td>[6]</td>
</tr>
<tr>
<td>Travel characteristics (weather, day of week, car ownership, weakness of public transit services, purpose of trip) and psychological variables</td>
<td>Ruhr University in Bochum, Germany</td>
<td>[48]</td>
</tr>
<tr>
<td>Subsidy availability, proximity to the bus station, short distance to university, gender, and educational status (graduate or undergraduate)</td>
<td>UCLA in Los Angeles, CA, USA</td>
<td>[49]</td>
</tr>
<tr>
<td>Gender, year of student, school location, residence status (rent or with family) distance, motorcycle license ownership, motorcycle ownership, and bicycle ownership</td>
<td>Six universities in Danang, Vietnam</td>
<td>[50]</td>
</tr>
<tr>
<td>Cost, personal attitudes, environmental factors, and travel time</td>
<td>McMaster University, in Hamilton, ON, Canada</td>
<td>[51]</td>
</tr>
<tr>
<td>Income, cost, travel time, car ownership, gender, residence location, and cost of parking</td>
<td>AUB in Beirut, Lebanon</td>
<td>[52]</td>
</tr>
<tr>
<td>Distance, gender, educational status (graduate or undergraduate), age, feasibility of travel with friends, feasibility of using multimodal modes, transit passes and discounts for students</td>
<td>UCLA in Los Angeles, CA, USA</td>
<td>[53]</td>
</tr>
<tr>
<td>Travel characteristics, personal behavior, socio-economic characteristics, and type of residence (on-campus or off-campus)</td>
<td>Four major universities in Virginia</td>
<td>[54]</td>
</tr>
<tr>
<td>Grade, household income, public transit coverage rate, bicycle ownership, university location, distance, and gender</td>
<td>Eight universities in the three typical higher education cities in China</td>
<td>[55]</td>
</tr>
<tr>
<td>Travel time, job status, and type of residence (on-campus, off campus, with friends, with family, or alone)</td>
<td>Arizona State University</td>
<td>[56]</td>
</tr>
<tr>
<td>Convenience, accessibility, reliability, flexibility, distance, safety, travel time, cost, and car access</td>
<td>University of Bologna, Italy</td>
<td>[57]</td>
</tr>
<tr>
<td>Status of bicycle lanes, on-campus security, bus costs, and frequency of busses</td>
<td>ULE, Spain</td>
<td>[11]</td>
</tr>
<tr>
<td>Socio-economic characteristics, situational characteristics, and beliefs</td>
<td>Two largest university campuses in Trondheim, Norway (Dragvoll and Gleshaugen)</td>
<td>[58]</td>
</tr>
<tr>
<td>Car ownership, walking distance, prioritizing physical activity, care about convenience, being aware of negative effects of using private cars</td>
<td>University campuses in Trondheim, Norway (Dragvoll and Gleshaugen)</td>
<td>[59]</td>
</tr>
<tr>
<td>Socio-demographic characteristics, car ownership, access to public transport</td>
<td>Iran</td>
<td>[60]</td>
</tr>
<tr>
<td>Access to bus service, subsidized transit, and short travel times</td>
<td>Los Angeles, CA, USA</td>
<td>[61]</td>
</tr>
<tr>
<td>Bike sharing reduces bus ridership among students</td>
<td>North Dakota State University</td>
<td>[62]</td>
</tr>
</tbody>
</table>
Table 1. Cont.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Case Study</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ease of use, shade, cleanliness, safety, and level of crowding at bus stops</td>
<td>Qatar [63]</td>
<td></td>
</tr>
<tr>
<td>Punctuality and reliability of bus service, the shelters at bus stops, and seating capacity</td>
<td>Malaysia [64]</td>
<td></td>
</tr>
<tr>
<td>Travel time</td>
<td>University of Wollongong, Wollongong, Australia [65]</td>
<td></td>
</tr>
</tbody>
</table>

This paper uses this information to consider the following questions:
RQ1: What factors and variables are most crucial for students to be able to use UBS effectively?
RQ2: To what extent are students satisfied with UBS specifications?
RQ3: What is the distribution of students using UBS in terms of frequency?
RQ4: What factors contribute to UBS popularity among students?
RQ5: In light of different factors, do UBS conditions seem fair to students?

4. Materials and Methods

To answer the research question and determine whether UBS effectively serves students’ travel demands, five steps are taken into account. A grounded theory (GT) is employed in the first step to determine which variables are effective for using UBS. The second step is to compare the satisfaction of students with different specifications of UBS. In the third phase, we compare the characteristics of students with the frequency with which they use UBS. Using structural equation modeling (SEM), the fourth step examines the impact of students’ characteristics and UBS specifications (determined in the first step) on popularity of UBS. Based on the results of the previous steps, we propose countermeasures to promote UBS and make captive users’ conditions fair. Steps 1 to 4 are described in the following sections.

4.1. Step 1: Grounded Theory

Grounded theory refers to a systematic method for conducting qualitative research that applies flexible methodological strategies. It is used when there are no predetermined theories or assumptions regarding a phenomenon [66,67]. Using real-world data, GT develops a theory based on the collected data [67]. Qualitative data is collected using non-numerical methods, including text, audio, and video [68]. It is possible to collect data regarding users’ experiences with GT systems [69].

This study uses GT to help understand how students value various UBS features and how this could affect their travel decisions. Twenty students were interviewed. Students’ voices were recorded during the interview with their permission. Transcripts were broken down into excerpts and reviewed in order to gain a better understanding of the responses. Four steps were taken to determine the variables that influence students’ opinions of UBS: open coding, axial coding, selective coding, and enfolding [66]. Using an open coding approach, context was extracted from excerpts [68]. In axial coding, codes are connected by finding connections between them [70]. Finding categories and subcategories through axial coding requires trial and error [71]. Following the identification of a core category that connects all codes, a theoretical framework based on selective coding is developed [71]. In order to identify the factors that influence students’ decision to use UBS, the GT outputs were analyzed.
4.2. Step 2: Students’ Satisfaction

The survey form asked students about their satisfaction with each parameter of UBS, as determined by GT. A five-point scale was used to rate each parameter: “very low”, “low”, “medium”, “high”, and “very high”.

4.3. Step 3: Comparing Students Based on Their Frequent Transport Mode

We divided students into four groups based on how frequently they used the service for university trips. “Students who frequently use UBS for their trips to/from the university (more than 60 percent of trips), “Students who occasionally use UBS for their trips to/from the universities (30 to 60 percent), “Students who rarely use UBS for their trips to/from the universities (1 to 30)” and “Students who never use UBS”. The distribution of students in each category was determined and compared based on their age, gender, income, education level, and frequency of private car use on a weekly basis.

4.4. Step 4: Structural Equation Modeling (SEM)

This step determines the impact of students’ characteristics and other factors (determined by GT in step 1) on the popularity of UBS (UBP factor). UBS popularity is a latent variable in the SEM, and its observed variables are frequency of use (UBF) and relative frequency (UBR) of use when compared to other transport services for university trips.

SEM is a popular method in social science which has been used in different transportation studies [12,72–77]. In order to solve the models, users need to use user-friendly software that is based on its theoretical foundation, can answer predefined questions, and can be generated using a variety of data sources [78–80]. Using SEM, predetermined hypotheses can be tested as well as interactions between variables [81]. We used a combination of regression analysis and confirmatory analysis with SEM [82]. CFA was used to test how well our data matched or fit a priori hypotheses about which items or variables are manifests of an underlying construct. CFA is used to determine whether measures of a construct are consistent with the researcher’s understanding of it. Consequently, CFA aims to confirm a hypothesized structural model by testing the data [83].

In this paper, the theoretical model was evaluated by taking into account the impact of characteristics of students, the specifications of the fleet, the characteristics of the station, the time factor, and the fare factor on the popularity of using UBS (Figure 1). These factors and their related observed variables were obtained based on the literature review and GT outputs.

Figure 1. Theoretical SEM.
5. Data

Students at Shahid Bahonar University of Kerman (SBUK) were surveyed for steps 2 to 4. SBUK is one of the largest universities in Iran. The university is located southeast of Kerman city (Figure 2). There are approximately 230 thousand square meters of educational space for more than 14 thousand students. There are 11 faculties and 64 educational groups at the university, and students study in more than 300 fields. Approximately 99 professors, 188 associate professors, 272 assistant professors, 46 instructors, and 555 staff and employees work at this university.

To determine the appropriate sample size for steps 2 and 3, Equation (1) is used [84]:

\[
n \geq N \left[ 1 + \frac{N - 1}{pq} \left( \frac{d}{Z_2} \right)^2 \right]^{-1}
\]

where \( n \): sample size, number of students for data collection; \( N \): population size, number of total students in the University campus (14,000); \( Z \): 1.96 for 95% confidence level, \( p, q \): the quality characteristics which are to be measured. Where no previous experience exists, the value of \( p \) is taken as 0.5 and \( q =1 - p = 0.5 \); \( d \): the desired level of precision and is considered 6.5%.

Equation (1) indicates that the number of students participating in the survey must be more than 223.

For step 4, which involves using SEM, the sample size was determined by the “ten times rule”. According to this rule, the sufficient sample size for SEM is 10 times the total number of links that connect the latent variables. In the proposed SEM, there are 5 links, as shown in Figure 1. In order to conduct the survey, at least 50 students must participate.

In SBUK, 330 students were interviewed, of whom 303 completed and returned acceptable forms. This indicates the sufficiency of the sample size.

Table 2 indicates the distribution of characteristics of the surveyed students.
Table 2. Distribution of the characteristics of surveyed students.

<table>
<thead>
<tr>
<th>Students’ Characteristic Factors</th>
<th>Variable</th>
<th>Abbreviation</th>
<th>Categories</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>GEN</td>
<td>Men</td>
<td>34.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Women</td>
<td>65.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>18–20</td>
<td>21.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20–22</td>
<td>47.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>22–24</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>24–26</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>26–28</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;28</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>AGE</td>
<td>B. S.</td>
<td>83.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M.Sc.</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ph.D.</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td>EDU</td>
<td>No Job</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Part-time Job</td>
<td>17.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full-time Job</td>
<td>5.9</td>
<td></td>
</tr>
<tr>
<td>Job status</td>
<td>JOS</td>
<td>&lt;10</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10–25</td>
<td>30.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25–50</td>
<td>17.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50–100</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100–250</td>
<td>6.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;250</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>Income (USD)</td>
<td>INC</td>
<td>No access</td>
<td>31.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0 days a week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rarely</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1 to 2 days a week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Occasionally</td>
<td>18.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3 to 4 days a week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All workdays</td>
<td>13.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5 days a week)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to private car in a week</td>
<td>APC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Results

The order of the results in this section is based on the steps introduced in the method.

6.1. Step 1

Table 3 summarizes the four main categories found using the procedure illustrated for GT. In addition, related subcategories for each main category are presented in this table.

Table 3. Categories and subcategories determined by GT.

<table>
<thead>
<tr>
<th>Main Category</th>
<th>Acronym</th>
<th>Sub-Category</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet characteristics</td>
<td>FLC</td>
<td>Comfort</td>
<td>COM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safety</td>
<td>FSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Security</td>
<td>FSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Age</td>
<td>FAG</td>
</tr>
</tbody>
</table>
Table 3. Cont.

<table>
<thead>
<tr>
<th>Main Category</th>
<th>Acronym</th>
<th>Sub-Category</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station characteristics</td>
<td>STC</td>
<td>Facilities/Amenities</td>
<td>FAM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Security</td>
<td>SSE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Safety</td>
<td>SSA</td>
</tr>
<tr>
<td>Time</td>
<td>TIM</td>
<td>Travel time</td>
<td>TRT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Walking time</td>
<td>WLT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Waiting time</td>
<td>WAT</td>
</tr>
<tr>
<td>Fare</td>
<td>FRE</td>
<td>Fare amount</td>
<td>FRA</td>
</tr>
</tbody>
</table>

6.2. Step 2

The satisfaction of students from the variables outlined in Table 3 is presented in Figures 3–5.

![Comfort](image1)
![Safety](image2)
![Security](image3)
![Age](image4)

Figure 3. Satisfaction of students from UBS specifications—FLC.

6.3. Step 3

According to how often students use UBS, Table 4 shows distributions of age, gender, income, education level, and days using private cars among students. Tables 5 and 6 display the distribution of income and access to private cars between male and female students.

6.4. Step 4

SEM outputs include the following:
- Path coefficients and t-values to demonstrate the relationship between factors (Figure 6).
- Cronbach’s alpha and composite reliability coefficient (CRC) to determine latent variable reliability (Table 7).
- Latent variable average variance (AVE) to prove validity (Table 7).
- Factor loadings and t-values for each observed variable (Table 8).
- Cross-loadings and Fornell–Larcker criterion to demonstrate discriminant validity (Table 9).
- Goodness-of-fit index for the overall model.

![Bar charts for Facilities/Amenities, Safety, and Security satisfaction levels.](image)

**Figure 4.** Satisfaction of students from UBS specifications—STC.

![Bar charts for Travel Time, Walking Time, Waiting Time, and Fare satisfaction levels.](image)

**Figure 5.** Satisfaction of students from UBS specifications—TIM and FRA.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Frequency of Using UBS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Never</td>
</tr>
<tr>
<td>GEN</td>
<td>Female</td>
<td>32.8</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>42.9</td>
</tr>
<tr>
<td>APC</td>
<td>No access</td>
<td>23.4</td>
</tr>
<tr>
<td></td>
<td>Rarely</td>
<td>25.1</td>
</tr>
<tr>
<td></td>
<td>Occasionally</td>
<td>51.3</td>
</tr>
<tr>
<td></td>
<td>All days</td>
<td>68.6</td>
</tr>
<tr>
<td>INC</td>
<td>&lt;10</td>
<td>27.9</td>
</tr>
<tr>
<td></td>
<td>10–25</td>
<td>34.8</td>
</tr>
<tr>
<td></td>
<td>25–50</td>
<td>30.2</td>
</tr>
<tr>
<td></td>
<td>50–100</td>
<td>45.2</td>
</tr>
<tr>
<td></td>
<td>100–250</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>&gt;250</td>
<td>64.7</td>
</tr>
<tr>
<td>AGE</td>
<td>18–20</td>
<td>36.9</td>
</tr>
<tr>
<td></td>
<td>20–22</td>
<td>33.3</td>
</tr>
<tr>
<td></td>
<td>22–24</td>
<td>34.3</td>
</tr>
<tr>
<td></td>
<td>24–26</td>
<td>70.6</td>
</tr>
<tr>
<td></td>
<td>26–28</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>&gt;28</td>
<td>50.0</td>
</tr>
<tr>
<td>EDU</td>
<td>B. Sc.</td>
<td>36.6</td>
</tr>
<tr>
<td></td>
<td>M. Sc.</td>
<td>34.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>APC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Access</td>
<td>Rarely</td>
</tr>
<tr>
<td>GEN</td>
<td>Female</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>14.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>INC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;10</td>
<td>10–25</td>
</tr>
<tr>
<td>GEN</td>
<td>Female</td>
<td>31.3</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>16.2</td>
</tr>
</tbody>
</table>

Figure 6 shows the proposed SEM for evaluating the impact of SCF, FLC, STC, and TIM on UBSP. This figure shows t-values in parentheses and path coefficients in other numbers. If the t value is greater than 1.96, then the path coefficients are acceptable at 0.05 significance, and if it is greater than 1.64, then the results are acceptable at 0.1 significance.
Table 7. Results of SEM reliability and validity.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Cronbach’s Alpha</th>
<th>CRC</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBP</td>
<td>0.89</td>
<td>0.95</td>
<td>0.9</td>
</tr>
<tr>
<td>STC</td>
<td>0.83</td>
<td>0.89</td>
<td>0.75</td>
</tr>
<tr>
<td>TIM</td>
<td>0.71</td>
<td>0.83</td>
<td>0.63</td>
</tr>
<tr>
<td>SCF</td>
<td>0.65</td>
<td>0.78</td>
<td>0.48</td>
</tr>
<tr>
<td>FLC</td>
<td>0.8</td>
<td>0.87</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Table 8. Discriminant validity (Fornell–Larcker).

<table>
<thead>
<tr>
<th>Factors</th>
<th>FRE</th>
<th>UBP</th>
<th>STC</th>
<th>TIM</th>
<th>SCF</th>
<th>FLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRE</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UBP</td>
<td>0.177</td>
<td>0.942</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STC</td>
<td>0.014</td>
<td>−0.130</td>
<td>0.866</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIM</td>
<td>0.233</td>
<td>−0.174</td>
<td>0.368</td>
<td>0.799</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCF</td>
<td>−0.010</td>
<td>−0.326</td>
<td>0.016</td>
<td>0.194</td>
<td>0.697</td>
<td></td>
</tr>
<tr>
<td>FLC</td>
<td>0.045</td>
<td>−0.086</td>
<td>0.846</td>
<td>0.382</td>
<td>0.075</td>
<td>0.791</td>
</tr>
</tbody>
</table>

Table 9. Discriminant validity by cross-loadings.

<table>
<thead>
<tr>
<th>Factors</th>
<th>FRE</th>
<th>UBP</th>
<th>STC</th>
<th>TIM</th>
<th>SCF</th>
<th>FLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>0.038</td>
<td>−0.074</td>
<td>0.474</td>
<td>0.256</td>
<td>0.152</td>
<td>0.762</td>
</tr>
<tr>
<td>UBR</td>
<td>0.172</td>
<td>0.986</td>
<td>−0.133</td>
<td>−0.173</td>
<td>−0.311</td>
<td>−0.092</td>
</tr>
<tr>
<td>UBF</td>
<td>0.164</td>
<td>0.897</td>
<td>−0.104</td>
<td>−0.152</td>
<td>−0.321</td>
<td>−0.060</td>
</tr>
<tr>
<td>APC</td>
<td>−0.024</td>
<td>−0.304</td>
<td>0.082</td>
<td>0.141</td>
<td>0.749</td>
<td>0.100</td>
</tr>
<tr>
<td>COM</td>
<td>0.004</td>
<td>−0.064</td>
<td>0.668</td>
<td>0.262</td>
<td>0.079</td>
<td>0.848</td>
</tr>
<tr>
<td>WLT</td>
<td>0.117</td>
<td>−0.112</td>
<td>0.301</td>
<td>0.701</td>
<td>0.181</td>
<td>0.302</td>
</tr>
<tr>
<td>FAM</td>
<td>0.070</td>
<td>−0.100</td>
<td>0.784</td>
<td>0.347</td>
<td>0.070</td>
<td>0.750</td>
</tr>
<tr>
<td>FRA</td>
<td>1.000</td>
<td>0.177</td>
<td>0.014</td>
<td>0.233</td>
<td>−0.010</td>
<td>0.045</td>
</tr>
<tr>
<td>INC</td>
<td>−0.106</td>
<td>−0.236</td>
<td>0.051</td>
<td>0.189</td>
<td>0.768</td>
<td>0.071</td>
</tr>
<tr>
<td>JOS</td>
<td>0.100</td>
<td>−0.192</td>
<td>−0.033</td>
<td>0.182</td>
<td>0.727</td>
<td>0.040</td>
</tr>
<tr>
<td>SSA</td>
<td>−0.016</td>
<td>−0.143</td>
<td>0.928</td>
<td>0.327</td>
<td>0.017</td>
<td>0.737</td>
</tr>
<tr>
<td>SSE</td>
<td>−0.012</td>
<td>−0.075</td>
<td>0.881</td>
<td>0.274</td>
<td>−0.068</td>
<td>0.721</td>
</tr>
<tr>
<td>TRT</td>
<td>0.221</td>
<td>−0.150</td>
<td>0.293</td>
<td>0.826</td>
<td>0.125</td>
<td>0.299</td>
</tr>
<tr>
<td>FSA</td>
<td>0.060</td>
<td>−0.081</td>
<td>0.807</td>
<td>0.395</td>
<td>0.012</td>
<td>0.825</td>
</tr>
<tr>
<td>FSE</td>
<td>0.033</td>
<td>−0.041</td>
<td>0.785</td>
<td>0.278</td>
<td>−0.046</td>
<td>0.722</td>
</tr>
<tr>
<td>WAT</td>
<td>0.206</td>
<td>−0.151</td>
<td>0.296</td>
<td>0.860</td>
<td>0.167</td>
<td>0.320</td>
</tr>
<tr>
<td>GEN</td>
<td>0.062</td>
<td>−0.115</td>
<td>−0.183</td>
<td>−0.040</td>
<td>0.516</td>
<td>−0.081</td>
</tr>
</tbody>
</table>
When Cronbach Alpha and CRC are close to one, they indicate high reliability [85]. In general, AVE values greater than 0.5 are considered acceptable [86]. Composite reliability (CR) scores above 0.60 can make AVE scores below thresholds valid [87].

According to the Fornell–Larcker criterion, Table 8 displays the results. This method compares latent variable correlations to AVE values squared. It is especially important that each construct’s square root is greater than its highest correlation with any other construct. The discriminant validity is shown in Table 8 (Fornell–Larcker criterion) [88].

Cross-loading can be used to test discriminant validity by comparing measures within each construct with those within other constructs. Measures of each construct must be low-correlated with each other, and measures of different constructs must be low-correlated.

7. Discussion and Conclusions

The purpose of this paper was to evaluate the quality and attractiveness of University bus services, and to identify ways that this service can better serve students’ demands in order to achieve sustainability goals. This assessment focused on the UBS at Shahid Bahonar University in Iran. Based on the results of a detailed survey, it is now possible to answer the research questions. The majority of students were dissatisfied with the bus service, station facilities, station security, and walking time to stations. When it comes to fare amount, UBS’s security, and waiting time, students had the highest satisfaction levels. Hence, the university administration can work on these parameters to attract students who are not regular users of UBS. Table 9 compares the specifications of UBS with other modes. Table 10 compares the specifications of UBS with other modes.

The survey indicates that most students were dissatisfied with the bus service, station facilities, station security, and walking time to stations. Students were more satisfied with the UBS’s fare amount, security, and waiting time.

UBS is used less frequently by male students than by female students. This probably reflects the fact that male students tend to have higher incomes and greater access to private cars, and as a result the UBS’s inadequacies represent a form of gender discrimination, which harms female students. Previously, in other papers in relation to developing countries, it was reported that women have more limitations in using bus services than male
passengers [12]. These limitations relate mostly to accessibility [89], feelings of safety and security [41], and violence and harassment [43].

Table 10. A comparison of available modes for daily commutes of students to university.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Total Costs (Per Trip)</th>
<th>Average Walking Time to Stations (min)</th>
<th>Average Waiting Time (min)</th>
<th>Average Travel Speed (km/h)</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBS</td>
<td>Free</td>
<td>&lt;15</td>
<td>60</td>
<td>25 to 30</td>
<td>Fixed</td>
</tr>
<tr>
<td>Public Bus</td>
<td>USD 0.04</td>
<td>&lt;15</td>
<td>30–60</td>
<td>25 to 30</td>
<td>Fixed</td>
</tr>
<tr>
<td>Taxi</td>
<td>USD 0.01 to 0.024</td>
<td>&lt;10</td>
<td>&lt;15</td>
<td>35 to 40</td>
<td>Semi-flexible</td>
</tr>
<tr>
<td>Uber</td>
<td>USD 0.3 to 1</td>
<td>0</td>
<td>&lt;10</td>
<td>40 to 50</td>
<td>Flexible</td>
</tr>
<tr>
<td>Private car</td>
<td>USD 1 to 1.5</td>
<td>0</td>
<td>0</td>
<td>40 to 50</td>
<td>Flexible</td>
</tr>
</tbody>
</table>

This study identified various factors that affect students’ use of UBS. As previously discussed, gender, income, and access to private cars have the greatest impacts on UBS usage. Previously, it was found that different characteristics of students, such as gender, educational status, income, age, car ownership, and job status, can affect their decision to use buses for university trips [48,50,52,54–56,58]. After students’ characteristics, station factor, bus factor, and time factor had the highest impacts on UBS popularity. In terms of the parameters of UBS that left students dissatisfied, bus age, station amenities, and walking time were the most significant factors. Previously, it was indicated that the ease of use, shade, cleanliness, safety and crowdedness level of bus stops, reliability, travel time, and frequency are important parameters to attract students [63]. In other studies, comfort, accessibility, safety, reliability, affordability, cleanliness, waiting time, walking duration, facilities for female passengers, and amenities were also reported as important variables to satisfy the passengers [90,91].

University decisions in developing countries are negatively influenced by automobiles, leading to a decrease in the sustainability of transportation. Furthermore, captive users of UBS are unfairly forced to use it despite dissatisfaction with some features that are important to them. University administrations can use this information to increase user satisfaction and attract more students to the UBS in order to achieve sustainability goals.

Theoretical and/or methodological contributions of this paper are not limited to this case study and the steps can be applied to other problems as well. Each case study can be adapted to the proposed method’s main idea.

The main limitation of this paper is that it ignores psychological factors of students, as well as the impact of other modes of transportation on the SEM. Another limitation is the lack of quantification of different variables’ effects on student satisfaction.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data available upon request.

**Conflicts of Interest:** The authors declare no conflict of interest.
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