

Improving Southeast Florida's Transit Ecosystem for Students  
A Cluster Randomized Controlled Trial (cRCT)

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# Improving Southeast Florida's Transit Ecosystem for Students

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**1. Project Summary (3 sentences or less):** Florida Atlantic University (FAU) will lead a collaboration with two area colleges and three transit agencies to plan, launch, and evaluate transportation solutions for 6,000 students in Fort Lauderdale, Boca Raton, and Davie. Local students who use transit often face lengthy travel and wait times due to inadequate bus and train schedules, while many more students who buy vehicles spend their limited incomes on car payments, gas, insurance and vehicle maintenance in a highly congested region. Of the 140,000 students at the three participating institutions, more than 40% received Pell grants, and more than 50% are students of color.

**2. Objectives:** The overall goal of the project is to evaluate a program to help students from disadvantaged backgrounds achieve success in college. The Kresge Foundation has identified transportation-related issues as one of the barriers facing minority and first-generation students that make it more difficult for students to attain their educational goals. By opening up a broader range of more affordable transportation options to south Florida campuses, this project endeavors to facilitate information on transportation alternatives, thus mobilizing more resources toward attaining academic goals.

The Cluster Randomized Controlled Trial (cRCT) portion of the study will focus on evaluating the use of information, marketing, and incentives to shape student travel behavior to campus through the three channels identified in Ajzen's (1991) framework (Error: Reference source not found).

We will evaluate whether a package of information, marketing, and incentives shifts student travel behavior to campus over one year, and in turn if these shifts in travel behavior result in improved academic performance.

Specific objectives of the cRCT include evaluating whether the intervention results in relatively:

1. Greater utilization of travel modes alternative to single-occupant vehicle travel (transit, biking, walking, bike-sharing, electric scooters, and carpooling)
2. Lower rates of car ownership
3. Superior college performance (higher GPAs)
4. More credit hours completed
5. Higher retention rates

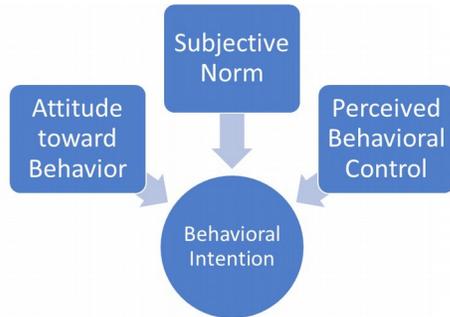
PLEASE SEE: RCT Evaluation Protocol for full details.

### 3. Introduction, Background, and Significance

## Use of Information and Marketing to Influence Travel Behavior

Information, marketing, and incentives have been used effectively to promote transportation alternatives (i.e. travel modes other than driving alone), especially in college campus settings (Ralph & Brown, 2019; Rodriguez & Rogers, 2014; Rose, 2008). This approach is grounded in the Theory of Planned Behavior proposed by Ajzen (1991). Ajzen argued that behavior is grounded in intention, and

that intention, in turn, is influenced by three considerations: 1) A person’s attitude towards the behavior, 2) their subjective norm, and 3) their perceived behavioral control.



A person’s attitude towards a behavior includes all of the positive and negative outcomes they consider likely to result from the behavior. For example, if a person believes they will be healthier if they bike to work, then they have at least in part a positive attitude towards that behavior. A person’s subjective norm concerns how they think others in their social circle evaluate such behavior, whether it is looked on as favorable or unfavorable. If driving or car ownership is considered a marker of status

among students, then such students will be more likely to select driving as the preferred mode. A person’s perceived

behavioral control is a person’s belief in their ability to put the behavior into action. For example, a student may want to take transit to get to campus but is unfamiliar with the way the local transit system operates. Having an app that can explain information such as board locations,

schedules, and fares may increase the student’s sense of perceived behavioral control with respect to taking public transit. Information, marketing, and incentives each can influence each of these considerations, creating the conditions for possible behavior change. Each of these considerations influences the formation of a person’s behavioral intention (See Figure 1: Azjen's (1991) Theory of Planned Behavior). Behavioral intention, in turn, is the prelude to behavior or behavior change.

PLEASE SEE: RCT Evaluation Protocol for full details.

The *Improving South Florida’s Transit Ecosystem for Students* builds on previous studies that have demonstrated the power of information, marketing, and incentives to shape student travel behavior to campus. One unique element in our study is the focus on the MaaS app as a means of providing continuous information and marketing to shape student travel behavior.

#### 4. Research Plan

##### (a) Research Design

This study is designed as an unblinded cluster randomized controlled trial (cRCT) in which a cluster of students who live in a particular residence off-campus will be randomly assigned to either the MaaS app or no app; students in a cluster assigned to the MaaS group will also receive information concerning housing options. Cluster randomization will be stratified by campus and whether the student is full or part-time; these stratification factors were chosen because of their influence on student travel modes and school performance. Cluster randomization will use a 1:1 ratio.

The trial will be conducted over one year. A pilot study of 200 students will test the randomization process on the responses from the Informed Consent survey. The pilot will be used to determine a likely response rate to the survey and to identify issues with the survey rollout. PLEASE SEE: RCT Evaluation Protocol for full details.

## (b) Research Methods

The Mobility-as-a-Service (MaaS) App will be provided to students in the Intervention Group and is intended to facilitate their use of alternative transportation modes such as public transit, ride-hailing, walking, biking, bike share, and e-scooter share to get to campus. The MaaS App will be downloaded to students' smartphones and will provide real-time, multimodal trip planning to students on demand when they open the app. This means, for instance, that a student can plan a trip that includes driving to a train station, taking the train, and then walking from the alighting train station to their final destination. The app will be white label, i.e. it will have a customized look and feel specific to the participating south Florida colleges, and it will have personalization features so that students can tailor the app to their travel patterns.

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The Cluster Randomized Controlled Trial (cRCT) portion of the study will focus on evaluating the use of information, marketing, and incentives to shape student travel behavior to campus through the three channels identified in Ajzen's framework (Error: Reference source not found).

There will be three sources of quantitative data: 1) student surveys will provide information on student travel behavior; 2) official academic records will provide data on student academic performance; and 3) student app usage will be derived directly from the app.

Student travel behavior for both intervention and control populations will be collected through regular surveys conducted at baseline and each of the two semesters (See Appendix 4 – Student Travel Behavior Survey for the full survey text). We will issue a baseline travel behavior survey at the beginning of the project and then issue regular surveys during fall and spring semesters for the one-year observation period.

We will also ask questions regarding the students' demographics, a few questions about attitudes towards alternative modes and self-reported BMI and health related quality of life, and a few questions concerning their suggestions for potential improvements for travel to campus.

These data will be complemented with academic performance and achievement data derived from official university/college administrative records. Student academic performance data will include grade point average for each semester, credit hours completed for each semester, and related academic outcomes, i.e. degree attainment, persistence in their program, and/or dropping out of their program. We will track the performance of students who transfer out of one of the three colleges via the National Student Clearinghouse Database. Using name and date of birth, we will be able to identify students who leave whether they dropped out or continued in another program. We will also be able to determine if they completed a degree.

## (c) Population

The study population will be students who live off-campus who attend any of the following three colleges or universities: Florida Atlantic University (FAU), Broward College (BC), or Palm Beach State College (PBSC). To qualify for the study, students must plan to be at the same institution for the next year. The sample will be derived from a population of almost 51,000 students living off-campus (see Table1 below). Students will be enrolled currently at one of four campuses: The Boca Raton campus—the

main campus for Florida Atlantic University (FAU) and a satellite campus for Palm Beach State College (PBSC); the Fort Lauderdale campus—a satellite campus for Florida Atlantic University and Broward College (BC); the Davie campus—the main campus for Broward College and a satellite campus for Florida Atlantic University; and the Lake Worth campus, the main campus for Palm Beach State College. The distribution of full-time and part-time off-campus students for each college and campus are provided in Table 1 below.

Table 1: Distribution of Off-Campus Students by College, Campus, and Enrollment Status

College	FAU	PBSC	FAU	BC	FAU	BC	PBSC	
Campus	Boca Raton	Boca Raton	Fort Lauderdale	Fort Lauderdale	Davie	Davie	Lake Worth	Total
Enrollment Status								
Part-Time	9,417	3,734	100	330	1,613	5,990	8,273	29,457
Full-Time	13,115	1,537	109	114	1,713	3,608	3,108	23,304
Total	20,647	5,271	245	444	3,326	9,598	11,381	50,912

## Recruitment

We will recruit students primarily through an email sent by each campus’ administration. However, we will engage in a concerted marketing campaign to recruit students to participate in the study. Also, the study will have a website and a social media page through which students can self-enroll. Students will be made aware of the study for several months before the enrollment email, by integrated web banners into administrative emails including banners on the parking page and administrative webpages such as Canvas. We will also produce flyers and posters and place them in prominent locations around each campus. Each ‘email contact’ will be a series of four emails: a heads-up email, two “action now” emails, and one follow-up email as a reminder or thank you. For more information on the student engagement strategy, see Appendix 2 – Promoting Participation in the Study to College Students.

## (e) Analysis Plan

From the data collected above in (b) **Research Methods**, we will derive the following major outcome variables, relevant to each of the major research questions:

1. Will students in the intervention group, subject to information, marketing incentives as delivered through a MaaS app, be more likely to use alternative modes to reach campus?
  - a. Students who always take alternative modes to campus
  - b. Students who sometimes take alternative modes to campus
  - c. Students who always take an automobile to campus
2. Will students in the intervention group, subject to information, marketing incentives as delivered through a MaaS app, reduce their level of car reliance?

- a. Student car ownership
  - b. Single-occupant vehicle travel
3. Will students who make more frequent use of alternative modes to campus and/or reduce car ownership have improved school performance?
- a. Grade point average
  - b. Credit hours earned
  - c. Retention, degree completion, drop out status, and/or transfer status, as relevant

Bivariate analyses will be conducted between each ordinal outcome (i.e. changes in transportation: from less green to green, or green to less green; grades) and demographic and commuting characteristics at baseline using logistic or ordinal logistic regression. Bivariate analyses between longer scale continuous variables (i.e. numeric grade point average) and demographic and commuting characteristics will be determined using linear regression. Associations between continuous outcomes and continuous covariates will be assessed using Pearson or Spearman Rank correlations. Covariates for which bivariate analyses result in p-values less than .20 for baseline and other covariates will be included in an initial mixed-effects (hierarchical) models along with variables and interactions that have been specified by content experts a priori. A monitored step-wise procedure will be used to eliminate covariates from the initial model: that variable with the highest non-significant p-value ( $p > .05$ ) will be eliminated (provided it is not part of an interaction effect). The final model will include significant variables as well as those determined a priori to control in every model (i.e. distance from residence to public transportation). Models with different covariance structures will be assessed, and that with the lowest Akaike Information Criterion will be chosen. Should these models not converge, generalized estimating equations will be used.

PLEASE SEE: RCT Evaluation Protocol for full details.

## Dissemination

White papers will be shared with the Kresge Foundation and internal stakeholders. The following is an expected schedule for research dissemination:

June 2020 – Nov. 2020 A white paper will be published to the CUES website describing the Improving South Florida’s Transit Ecosystem for Students project, the Transit Working Group partnership, and its goals. cRCT study protocols will be submitted to a peer-reviewed journal and submitted to a conference for presentation.

November 2020 – October 2021 - White paper and possible peer-reviewed manuscript citing methodologic concerns observed in a trial of this magnitude for this content area. Conference presentation on the travel behavior impacts of the MaaS app and accompanying marketing and information efforts will be submitted to a major transportation conference.

November 2021 – October 2022 - Paper on the travel behavior impacts of the MaaS app and accompanying marketing and information efforts will be submitted to a peer-reviewed journal. Paper on



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the academic performance impacts of the MaaS app and accompanying marketing and information efforts will be submitted to a peer-reviewed journal.

After October 2022 - White paper and conference presentation on the travel behavior impacts of the first-mile, last-mile solution will be submitted to a peer-reviewed journal.

(f) **Compensation to Participants.** If participants complete all five surveys associated with the study, they will receive a VIP hotel voucher for discounts valued at \$75.

**5. Benefits:** Treatment group participants will have access to information that enables them to travel to campus more readily.

**6. Risks:** Although the data will be kept securely and only made available to study researchers and administrators as outlined in the data management plan, there is some risk involved in storing personally identifiable information. Otherwise, there is no significant risk of participating in the study.

**7. Informed Consent Process:**

(a) Each college will invite students who meet the following exclusion criteria to participate in the study:

- Enrolled as of September 1, 2020
- The student lives off-campus
- The student is enrolled at FAU, Broward College or Palm Beach State College and is affiliated with either the Boca Raton, Fort Lauderdale, Davie or Lake Worth campus

The invitation to participate in the study will ask the student to provide informed consent, and will ask four exclusion questions:

- Do you live off-campus?
- If student lives off campus, what is their address?
- Do you own a smartphone?
- What is your smartphone number? (for study communication purposes)
- Do you expect to be at [the same institution] until December 2022?

If the student answers 'yes' to the above questions, provides their phone number, address of residence and informed consent, then they will be enrolled in the cRCT and randomized when enrollment is complete.

The flow of students to be enrolled in the study is presented in Figure 2: Sample Flow Diagram below.

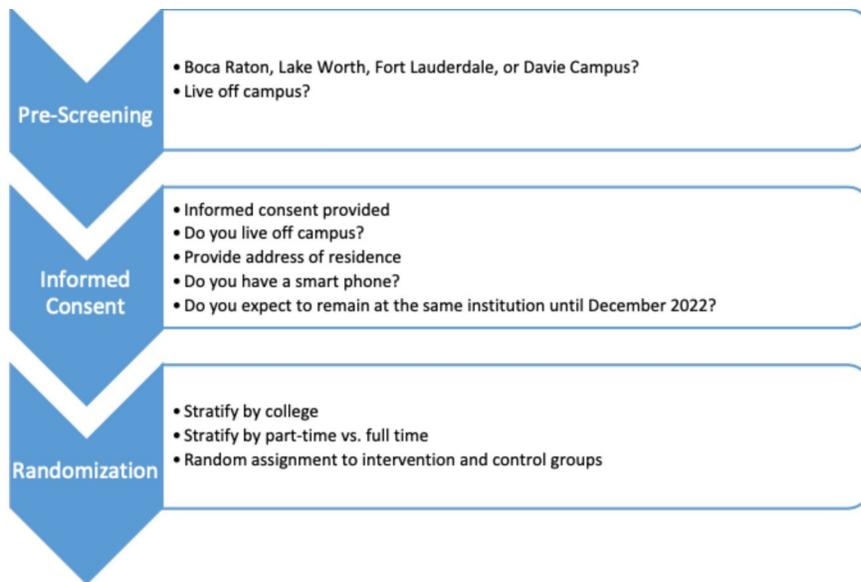


Figure 2: Sample Flow Diagram

- (b) No deception will be used.
- (c) We do not plan to enroll cognitively- or decisionally- impaired subjects.
- (d) We do not plan to enroll prospective subjects as emancipated minors.
- (e) We do not plan to recruit non-English speaking subjects.

**8. Informed consent will be online.**

**9. Research Materials, Records, and Privacy:**

**Survey Data**

We will have two sets of data on students in the study. The first data set will be only used for communications about the study itself, such as requesting students to complete surveys. This will be referred to as the “Student Communications Data Set.” The second data set will be for the analysis of travel behavior and student performance. This will be referred to as the “Student Performance Data Set.” The Student Performance Data set will be de-identified – the only identification information on the Student Performance Data set will be a study ID number linking the information to the Student Communications Data Set.

To securely store the repository of the Student Communications Data Set we will utilize restricted access within the Florida Atlantic University (FAU) domain. The data will be encrypted and stored on a private server housed within the School of Urban and Regional Planning’s (SURP) datacenter. The server is on the FAU private network and behind the network’s firewalls protecting it from the broader public internet. The data will also be behind the server’s firewall configured for limited network access. A private shared file will be established on the server to store the data. Only approved researches involved in SURP operations, as well as this specific study, will have access to the data. Authentication will be

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handled by Active Directory using users' FAU netid and password. Also, the file storing the data will employ 256-bit key AES password protection. Any member of the research team who requires access to the data will request permission from Dr. Renne (or his designee) and must be approved before receiving the data. Access to the Student Communications Data Set will be maintained by Dr. Renne or his designee.

To securely store Student Performance Data Set we will leverage FAU's Biomedical and Health Research Informatics Core (BHRIC) -- a secure, private cloud, encrypted file storage and isolated network infrastructure managed by the FAU Office of Information Technology (OIT). This isolated health network is protected by an independent firewall and remote access is provided by a Virtual Private Network (VPN). Data security is assured by Virtual Routing Forwarding (VRF); 2Factor VPN authentication; 10 Gbps Juniper Firewall; Web Proxy Security; Load Balancer; Dell XC Web-Scale Converged Appliances running Windows Hyper-v with Azure; Desktop Virtualization with Desktop connections; and Disaster Recovery.

To securely share the Student Performance Data Set, authorized access to the Health VRF must first be granted. The Health VRF is an isolated, protected network perimeter through which covered components, Colleges, individual units, or individual PCs can be fenced in. This perimeter enforces the necessary security and compliance restrictions needed to protect data from external threats. Within the Health VRF, SURP can secure data and selectively share data with investigators and collaborators if required. Only through an extensive and formalized access request process to the BHRIC may an investigator access any data collected on behalf of SURP.

Only approved researchers involved in SURP operations, as well as this specific study, will have access to the data. Any investigator who would like to analyze de-identified data will request permission from Dr. Renne (or his designee) and must be approved before receiving the data.

Access to the Student Performance Data Set will be maintained by Dr. Renne or his designee. If access is granted, all Student Performance Data Set materials sent to investigators outside of this study will be assigned a unique code and will not identify the participant. The master list with ID numbers and identifying names will be securely stored in an encrypted file format approved by the Office of Information Technology's Security Office and not shared with anyone beyond Dr. Renne.

Additionally, as part of the BHRIC infrastructure, all supplementary files and forms will be fully encrypted at rest and in transit using the highest recommended standards.

Data from this study will be destroyed three years after the final survey.

#### Student Communications Data Set

- Full name
- Affiliated college
- Affiliated campus
- Student ID number
- Official student email address
- Phone number
- Study Unique ID number

- Randomization number
- Intervention/Control Dummy Variable (1=in Intervention Group; 0= in Control Group)

Student Performance Data Set (De-identified)

- Current enrollment status
- Graduate status
- Credit hours earned
- Grade point average
- Travel behavior data
- Residential address
- Study Unique ID number
- College
- Gender
- Race/ethnicity
- Primary campus
- Full time / part time
- First Generation
- Financial aid

### Application Data

The mobile application, MaaS App, will be developed by software development and tech consulting agency, daruma tech. To facilitate the infrastructure required to run the application SURP will install a server running Windows Server 2019 in their on-campus datacenter. The server will be placed in a small DMZ which is an isolated part of the FAU network. In the DMZ, the server will be configured to have limited access from the public internet and restricted access to the FAU network. Two applications will be installed on the server to run the MaaS App, MS SQL Server 2019 and Open Trip Planner. The only student data stored in the SQL database will be an email address to confirm they are participants in the study and their primary campus to facilitate campus-by-campus analysis of app usage patterns.

Aggregate app usage data stored in the database will include the following: How many times the app has been downloaded, how frequent the app is being used per week, if push notifications are turned on or off, number of times a particular transit route or transit stop is selected, modes selected in routing, i.e. walking, biking, scooters, etc. This aggregate data will in no way be tied to the student email address. The data coming through the Open Trip Planner app is publically available data. The SQL database data will be encrypted at rest using at least AES 256-bit encryption and communication between the mobile app and the servers will be encrypted using SHA-256-bit encryption. All data stored within application on the mobile device, which includes student email address and favorite locations, will also use AES 256-bit encryption.

Data from this study will be destroyed three years after the final survey.

**10. Resources:**

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(a) Describe what resources/facilities are available at FAU to perform the research (i.e., staff, space, equipment).

The team will be led by FAU transportation planning professor, Dr. John L. Renne, AICP, who has worked on similar projects at the University of Colorado at Boulder, Rutgers University, Murdoch University (Australia), University of New Orleans and Tulane University. Dr. Louis Merlin, AICP, a leading transportation planning scholar with a focus on accessibility research and emerging technologies will also help lead this team. Dr. Katherine Freeman, Professor and Biostatistician collaborated on the study design by drafting the biostatistical considerations and power analysis sections and reviewing all methodologic aspects. Doctoral student and CUES Outreach Coordinator Ms. Serena Hoermann will support this grant and help manage student engagement. Graduate research assistants will be engaged as needed.

We do not anticipate the need for psychological, social, or medical services, counseling or social support services due to research participation.

(b) Identify what resources from other sites may be needed to conduct the study.

Broward College and Palm Beach State College will also support this study. Please find letters of support from the respective colleges in the supplemental documents.

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