Exploring Ways of Influencing Transport Behaviors by Using Telecommunications Technologies

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16. Abstract

Information technology can facilitate substitution and modification of transportation behaviors. Distance Learning (DL) can replace library work, meetings, and some traditional face-to-face class meetings. For off-campus full-time students, and for part-time working and non-traditional students the potential for reducing traffic to campus is considerable. Telework can affect commuting volume and patterns. The potential for these changes is considerable; however, many of the promised benefits have not yet been realized. The primary reason is human behavior though technical factors and costs also hinder the change.

The studies reported here identify a number of variables predicting the use of DL as a substitute for travel: level of computer use, perceived convenience, money savings, and fewer days in class. More than one third of students reported using the Internet to avoid travel to campus. Students reported reduced time for travel resulting from increased computer use. As far as future intentions, distance learning was expected to affect the number of days students travel to campus rather than the type of transportation used. A second, methodologically different, study of students' actual behaviors suggested that courses using the Internet/WWW can significantly reduce the number of days students travel to campus.

This study also reports on data collected from a sample of workers in Rhode Island, United States, to examine factors that form the telecommuting preference. Multivariate analyses indicate that work time flexibility, employer encouragement, educator as the occupation, having access to Internet at home, using computers longer than one hour a day, having more computers at home, and perceiving that using the Internet can reduce time travel to work and to shop are positively related to using or intending to use Internet to substitute for travel to work.

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I. INTRODUCTION

Automobile travel is increasingly associated with pollution, congestion, urban sprawl, as well as social and economic costs both for drivers and communities. Travel volume is growing and is increasingly taxing community and private resources. When the length of the average commute is stretched and when much of that time is spent stuck in traffic, even the subjective experience of travel is negatively affected. Experts agree that building additional highways is undesirable both ecologically and financially.

Mobility has become an economic as well as a lifestyle attribute in advanced societies (Zelinsky, 1971). Zoche, Kimpeler, and Joepgen (2002) point out that circular mobility (i.e. mobility without change in residence) has increasingly attracted research attention due to its environmental impact on pollution, congestion, noise, etc. Since communication is no longer tied to physical transport, many functions that required physical travel earlier can now be fulfilled via communication media. Increased communication, however, also often triggers greater need for physical transport of persons and goods. Canzler and Knie (2000) found that the amount of time spent on travel has remained constant, but the distances covered tend to increase consistently.

Interactive technologies for activities which otherwise require physical transport can aid in the reduction of miles traveled and create environmental, social, and economic gains. Telework, telebanking, teleshopping, telemedicine, and distance learning generate considerable revenue (Mundorf and Bryant 2002). Savings in transaction and agency costs (Dholakia, Dholakia and Park 2002) may be passed on to the consumer. Improved access to education, health care, and employment opportunities may benefit the physically challenged or those living in remote locations. Primarily human behavior but also technical factors and costs have prevented this potential from being realized. Americans engage in a pattern of single-occupant vehicle travel, inspite of increasing pollution, congestion, and inconvenience.

A number of studies have explored the impact of information technology on travel behavior, specifically related to telework (Nelson and Niles 1999). Mokhtarian (1997) found substitution effects for telework. Zoche, Kimpeler and Joepgen (2002) demonstrated such effects for telebanking. The environmental impact of online shopping is unclear but a substitution effect for trips to shopping centers and stores may be offset by deliveries to residential areas. While there is some work on factors affecting the demand for distance education (e.g., see Farrell 1999), there is virtually no research on the impact of distance learning on travel behavior.

Telecommunications, and in particular the Internet, have brought changes to many areas of life. Mokhtarian (1990) conceptually discussed the variety of demand and supply relationships between telecommunications and transportation. She points to the substitution impact of telecommunications on the demand for transportation, but argues that telecommunications can also stimulate travel. Niles (1994) considers both the trip elimination effects of telecommuting and its trip generation potential. Notably, telecommunications may lead to greater urbanization and a wider range of economic activities, which can yield increased traffic volume.

Recently the term, *virtual mobility*, has been used to encompass the complex relationship between information technology and physical transport. In a large-scale study, Zoche et al. (2002) analyzed the travel impact of virtual mobility in three areas: chat, online banking, and online travel offerings. Even though all three modes have potential for travel reduction, only online banking led to a net reduction in miles traveled. For the other two, the potential miles

saved were offset by increased travel resulting from new acquaintances and group memberships (chat groups) or from travel bargains found online vs. traditional travel booking channels. Overall, the potential of information technology to stimulate travel is not yet well understood.

This project addressed two main aspects of virtual mobility: Distance Learning and Telework. The following report will detail key findings of our studies and relate them to the overall idea of virtual mobility.

II. VIRTUAL MOBILITY: DISTANCE LEARNING

The concept of "distance learning" (DL) has been in existence for more than a century. In recent years, the widespread availability of networked computers and of satellite and videoconferencing technology extends DL beyond traditional students (Jones 2002; Patterson 1999). DL permits students to participate in many academic activities from home, work, or satellite locations. It can replace trips to the library, to meetings, and to traditional face-to-face classes. For off-campus full-time students, the potential for reducing traffic to campus is considerable. This reduction may be even greater for part-time working, non-traditional students.

The issue of reducing or modifying travel through DL has not been addressed in a satisfactory way. For instance, Shifter (2002) lists 29 motivating and 17 inhibiting factors for faculty participation in distance learning programs. The only one even remotely travel related is ranked 27 out of 29 motivators: "Ability to reach audiences that cannot reach classes on campus." Similarly, Halsne and Gatta (2001) compared learner characteristics of traditional and online students and none was related to transportation. If there is a traffic-reduction impact of DL, it should be expected to increase with the amount and frequency of DL. To better understand trends in DL we will address organizational and individual factors that facilitate and inhibit it.

IMPACT OF DISTANCE LEARNING

On the Individual

The impact of DL is social, economic, and educational. The evidence of the *social* impact of home IT use on individuals is controversial. Though some researchers claim an increased sense of isolation and less time spent with friends and family, others stress that home IT provides an alternative means of communication to those who are socially isolated or otherwise disadvantaged (Mundorf and Laird, 2002). DL is frequently a self-selected activity for students with work and family commitments; thus, effects of social isolation should be limited. For instance, DL can facilitate daycare arrangements. In some circumstances exclusion from the social network of the face-to-face classroom can be one of the drawbacks of DL.

The *economic* effect of DL is difficult to assess since the growth of this phenomenon is fairly recent. Often DL permits students to retain a job, which may be difficult to reconcile with traditional classroom learning. Time savings can translate into added income opportunities. A degree can be completed once a student moves to a remote location. Most universities charge comparable rates for in-class and online instruction. It could be expected, however, that over time students will have increasing opportunities to 'shop' for educational bargains, especially using DL methods. Many students adopt high-speed Internet service in order to facilitate DL requirements. The need for new computer hardware often arises as well. This cost however may be offset by reduced transportation, and savings in parking and miscellaneous expenses.

Proponents of *traditional educational* practices are often opposed to virtual classrooms because they feel that the immediacy of the educational experience is lost. They also raise concerns about group dynamics among students, technical failure, accountability, and testing. Kreijns, Kirschner, and Jochems (2002) report that many DL programs take group interaction for granted and fall short in addressing aspects of non-task related social interactions. Encouraging arguments for DL have emerged, including a study of M.A. students in Education that found that DL students scored higher in eight areas of teaching effectiveness compared to students in a traditional program. DeLacey and Leonard (2002) report successful distance learning initiatives at the Harvard Business School in a program that includes some initial face-to-face encounters. Lindner, Dooley, and Kelsey (2002) also found predominantly positive interactions with faculty and cohort groups in an agricultural education setting in Texas.

On Educational Institutions

American universities have embraced DL to varying degrees. Some have seen it as a profit opportunity, while others are adopting it reluctantly to keep up with the competition and not be perceived as backward. Even within given departments faculty members differ considerably as far as adoption is concerned. While some institutions are offering full-fledged distance learning programs, including online degrees, the majority of postsecondary institutions have adopted the concept only gradually. In the case of law education, for instance, the American Bar Association is considering a proposal to allow accredited law schools to offer distance courses (Carnevale, 2002).

Mingle (2002) points out that cost of traditional classroom instruction is essentially proportional to the number of students. While the initial cost of distance learning is high, the incremental cost per added student is negligible. The quality of the learning experience, as well as the relationship between technology, learners, and institutional needs are key concerns (Cavanaugh 1999; Decker, Vega, Shallit and Wills 2000; Hecht and Klass 1999; Hodge-Hardin 1997). At the University of Rhode Island, and similar institutions, demand for DL outpaces supply, especially in the summer, when many out-of-state students return home.

On the Corporate Sector

While the primary focus of this paper is virtual mobility in the academic sector, trends in corporate DL could affect academia and vice versa. Corporate DL differs from academic DL in the following ways:

- Technology and "high tech" tools are more easily available in the corporate world,
- Lost work time is a major focus,
- Travel expenses are high for multi-site and global companies,
- The content is more task oriented in the corporate world,
- An increase in time savings and productivity may be the measure of success,
- A knowledge management infrastructure is critical for corporate DL to be effective.

On Transportation Systems

Distance learning impacts transportation systems by eliminating the need for students to leave home and travel to the classroom. However, some concerns exist that DL could *stimulate* travel in several ways (Mokhtarian, 1990), including short-term direct (more travel results from more information), short-term indirect (time saved traveling to class is used for other travel), and long-term (reaching more remote students) effects.

DISTANCE LEARNING CASE STUDY

The University of Rhode Island is located in Kingston, RI, in the southern part of the state. Students at URI commute both to classes on campus and to work away from campus, seriously affecting traffic in rural southern Rhode Island, particularly in South Kingstown. Like many universities located in rural areas, the University of Rhode Island exacerbates the local traffic problems with students, faculty and staff traveling to and from campus on roads designed for light rural traffic. In terms of travel planning, administrators are exploring ways to encourage alternatives to automobile travel, including increased bus services to campus, reduced bus fares, shuttle services from distant parking lots, and restricting automobile traffic (Carothers, 2001).

Aside from specifically designed distance learning classes, University of Rhode Island students use the Internet during the academic year in ways that may reduce their need to travel to campus. These include: online registration, online library access, online instructor contact, online assignments submission, class websites, and online course-related chat. During the summer, web-based courses are currently offered to attract out-of-state students to URI. The potential of DL to relieve the traffic problems is part of the focus of this study. This project's findings will contribute to the state and university traffic plans, helping in the reconstruction of routes and parking arrangements at URI and in the surrounding areas.

Survey One: Phone Survey of URI Students

Survey Method and Sample

A telephone survey was conducted in April 2000, by an on-campus (URI) polling service. The questionnaire, including questions regarding transportation, telecommunications behaviors, and demographics, was administered by phone to a sample of students randomly selected from URI's internal database. Each interview lasted about 10 minutes and the information was recorded manually on a printed form.

A total of 572 telephone connections were made with 220 surveys completed. The overall response rate was 38.5%. Because the purpose of this study was to identify students' intentions to use Internet-based education to substitute for travel to campus, only off-campus students (a sample size of 155) were selected in the analyses.

As shown on Table 1, the survey yielded a student sample comparable to URI's student profile, in terms of gender and program of study. Compared to the University's profile, more full-time and undergraduate students participated in the survey. Based on this comparison, we feel confident that the sampled students are representative of the student population at URI.

TABLE 1. Telephone Survey Sample and URI Student Population

	Survey Sample	University Statistics[1]
Total Observations	220	14,362
Gender		
Male	41%	43%
Female	59	57
Student status		
Full time	78%	69%
Part time	22	31
Class		
Undergraduate	82%	77%
Graduate	18	23
Program of Study		
Business	12%	13%
Education	10	8
Engineering	8	7
Psychology, Communication Studies & Human Development and Family Studies	14	16
Pharmacy & Nursing	12	7
Other	44	49

[1] From "Fall 2000 Campus Highlights" provided by University of Rhode Island

Survey Findings

Travel and Computer Use Behaviors

Table 2 presents descriptive statistics on transportation and computer use behavior among off-campus students. Almost all the students (92.9%) drive their own car. Most students (70%) take classes 3-5 days per week. Travel to class is high during the morning commute (7 to 9 a.m.), and peaks between 9 and 11 a.m., while return times peak between 2 and 4 p.m. Most off-campus students reach campus in less than 20 minutes. In terms of computer access, almost all (97.4%) have Internet access, and 85.2% of students have Internet access from home. A very limited number of sampled students (4.5%) were currently taking distance courses.

Given the very high proportion of car use (93%), it would seem that changing car use behavior would be a meaningful exercise. There is however very little interest in using carpools or public transportation as a means of traveling to campus (Table 3). Only 14% indicate that they currently use carpool or public transportation and another 6.5% show some interest in these alternatives in the near future, while most (79.4%) show no interest in such behavior changes.

TABLE 2. Transportation and Computer Use Behaviors (N=155)

Variable	Percentage
Transportation: Drive own car	92.9%
Number of days going to class	
1 –2 days/week	27.7%
3 – 5 days/week	70.3%
Don't take class	1.9%
Time going to class (peak periods)	
7-9AM	31.1%
9-11AM	45.0%
Time returning home (peak periods)	
12-2PM	21.2%
2-4PM	35.8%
Number of minutes going to class from home	
<=20 min	50.9%
> 21min	49.0%
Currently access Internet	97.4%
Home PC with Internet access	85.2%*
Currently take distance courses	4.5%

*This number has increased as of 2004

TABLE 3. Intentions to Change Travel Behaviors

Variable	Carpool/Public Transportation	Internet/World Wide Web
Currently use	22 (14.2%)	53 (34.9%)
Intend to use in the future	10 (6.5%)	10 (6.6%)
No Intentions to Use	123 (79.4%)	89 (58.6%)
(Missing)		3

Internet Substitution for Travel to Campus

The questionnaire also included two questions to assess the potential of information technology to influence or substitute travel:

- "Do you use the Internet/World Wide Web so that you avoid traveling to campus now?"
- "If Internet/web courses such as WebCT courses were to be offered more fully by URI, would your enrollment in these courses affect any of the following:
  a) number of days traveled to campus and
  b) types of transportation used for traveling to campus

The key variable was whether or not students use or intend to use the Internet/WWW to avoid traveling to campus. The responses indicate that 35 % of the sample currently attempts to avoid travel via the use of the Internet/WWW although 58.6% do indicate that they have no intentions to do so in the future. Responses to the second question indicate that more people

would change the number of days traveled (55.5% said yes) than change types of transportation used (11% said yes).

Table 4 presents the results of ANOVA analysis, which presents the relationship between current and future intentions and the numbers of days attending class. Using only two groups (current/future users and no intentions), the survey found the key results are the following:

- The number of days per week going to class was negatively related to use of Internet as a substitute for travel: users went to class an average 3.1 days a week compared to 3.9 days for nonusers.
- Number of days per week going to class was negatively associated with changes in the number of days traveling to campus (3.25 vs. 3.82 days among students who reported change or not).

TABLE 4. One Way ANOVA Results.

Dependent Variable: *# of days/week going to class*	N	Mean	Std. Dev.	F	p
Independent Variable					
a. Carpool/Public Transportation				8.33	.004
nonusers	92	3.89	1.52		
users	63	3.14	1.63		
b. Internet /WWW to avoid travel				5.16	.03
will change	86	3.25	1.50		
no change/don't know	67	3.82	1.57		

Note: This table reads, for example, students who have fewer days of classes per week would be more likely than those who have more days of classes (3.14 vs. 3.89 days) to use/intend to use Internet to avoid travel.

Learning from the Past - The Potential Impact on Direct and Indirect Travel Behaviors

Since few sampled students (4.5%) were currently enrolled in distance courses (partly because URI was still at an early stage of offering Internet-based courses), we attempted to infer the potential impact of distance education on travel behavior through the effects of general Internet use. We examined the question “Has there been any change in the amount of time you spend on various activities since you started using the Internet?” We provided eight situations, four of them travel related, such as travel time for school, work, shopping, and socializing related activities. Table 5 reports the frequencies. For most activities, students generally reported no change or did not respond. School and work related travel activities saw both increased and reduced time, shopping was associated with reduced time while socializing was associated with increased time.

TABLE 5. Direct and Indirect Effects of Internet Use on Travel Behaviors

Type of Travel	Change in the amount of time since started using the Internet		
	more time	*less time*	*no change/ no response*
Travel to school	12%	20%	68%
Travel to work	7%	8%	85%
Travel for shopping	4%	19%	77%
Travel for socializing	8%	3%	89%
Net time	13%	29%	58%

To estimate the net effects of Internet use on travel time, we recoded the variable (more time as 1, less time as -1, and no change/no response as 0). The scores were added together to create "net-time" which can be viewed as a measure of net effect of Internet use on travel time. The results indicate that 29% of the respondents reported spending less time for travel because of Internet use, while 13% reported spending more time for travel.

Summary

Based on these results from the phone survey of undergraduate students, we can conclude that tele-education has the potential to impact travel behaviors. Given the demographics of the school population, more students are likely to use the Internet to substitute for travel behaviors than modify their travel behaviors through the use of carpools or public transportation. We could not, however, assess the actual impact of tele-education on travel behaviors from the phone survey.

Survey Two: Survey of URI Students Participating in DL

Survey Method and Sample

In order to examine the actual impact of the Internet on travel behaviors, a follow-up study was conducted among students of a specific course taught by one of the researchers.

During the Fall 2001, one of the researchers was scheduled to teach an undergraduate course three times a week with one day of the weekly schedule set aside for online delivery of the course content using WebCT, an online course delivery platform. The online delivery allowed students to complete the course requirement without attending class on that day; however, it may or may not have obviated travel completely for these students since not all courses followed this particular option.

Three times during the semester, the students in this upper level elective course completed a questionnaire designed specifically for them. In addition to assessing the effectiveness of various components of the course design, the questionnaire addressed the use of the Internet and the impact on travel behaviors. Each student completed the questionnaires and the results were entered into a database and analyzed. Table 6 highlights some of the student

characteristics from Study Two. The gender composition of this sample is similar to Study One and the University population. Computer access is also very similar.

TABLE 6. Study Two: Selected Sample Characteristics

Gender:	*N=50*	Male 46%	Female 54%
WebCT experience	*N=50*	First time 24%	Prior Experience 76%
Number of courses	*N=50*	Five or less: 66%	Six or more: 34%
Computer at home	*N=45*	None: 6%	One or more: 97%

Survey Findings

Actual Impact on Travel Behaviors

At the end of the semester, the students were asked "As a result of WebCT, how many days per week did you AVOID coming to campus?" Responses ranged from zero to 5 days per week and most people (67%) responded zero days. The remaining students responded they had avoided 1 to 2 days per week. For further analysis, we grouped these responses into two groups - zero and one or more days. We conducted a discriminant analysis to determine the influence of four key variables:

- Ratio of courses using WebCT – to reflect the degree to which overall use of technology in all the courses allowed avoidance of travel,
- Number of days attending classes – to reflect the degree to which overall course load allowed avoidance of travel,
- Distance from campus (measured in terms of time to travel) – to reflect the degree to which travel time (as a measure of motivation) allowed avoidance of travel, and
- Overall attitudes toward Internet-based courses – to reflect the degree to which personal preferences influenced avoidance of travel.

The discriminant function significantly distinguishes the two groups (see table 7). As expected, students with a course load that met on *more* days per week avoided *fewer* days of travel. To avoid *more* days of travel, students had to have favorable attitudes toward Internet-based courses, be enrolled in courses with greater use of WebCT, and live farther away from campus (in terms of travel time). Further explorations indicate that those people who *did not avoid* any day of travel offered the following reasons: other courses (100%), library assignments (32%), other activities (26%), and work on campus (26%).

TABLE 7. Discriminant Analysis: Number of Days Avoided as a result of WebCT

Variable	Standardized Coefficient
Number of class days	-.786
Attitude towards Internet-based courses	.579
Ratio of courses using WebCT	.473
Travel time to first class	.300
Canonical Correlation = .51, Wilks' Lambda = .74, Chi-Square 11.72, df = 4, p<.02	

Given the deployment of a Web-based technology in a specific course, the impact on travel behavior is direct. Students reported some avoidance of travel behaviors and this was facilitated when other courses also used the technology and when students had preferences for such technology. When asked their future intentions regarding the use of WebCT, students who avoided travel also preferred the use of WebCT and gave the avoidance of travel as one of the reasons for their preference (Table 8). The increasing use of technology reported by all students, regardless of the impact on their own travel behaviors, implies that future travel behaviors are likely to be further impacted as one of the constraints (not all courses using WebCT) gradually diminishes in importance.

TABLE 8. Chi-square Test Results: Future Intentions

Variable	Zero days Avoided	One or more days avoided	χ^2	p
Attitude towards WebCT:			3.6	.05
Prefer WebCT	18 (31.6%)	14 (24.6%)		
Indifferent or Prefer In Class	20 (35.1%)	5 (8.8%)		
Can AvoidTraveling to Campus			9.8	.01
Agree or Strongly Agree	11 (19.6%)	14 (25.0%)		
Neither Agree/Disagree	10 (17.9%)	2 (3.6%)		
Disagree or Strongly Disagree	16 (28.6%)	3 (5.4%)		
Use of WebCT by Instructors:			<1	ns
More than Last Year	32 (56%)	16 (28%)		
Less than Last Year or No change	6 (11%)	3 (5%)		

CONCLUSIONS FROM DISTANCE LEARNING CASE STUDY

The findings of this section of the report, focusing on the potential and actual impact of DL on travel behavior, indicate promising use of the Internet to substitute for traveling to campus. DL is more likely to impact the number of days traveled to campus than alternate transportation modes. Offering courses with DL technology will significantly reduce the number of days students travel to campus. Students however will continue to travel for non-course related activities.

Individual differences remain a major factor with students who prefer DL as well as avoidance of travel much more likely to choose courses that reduce their travel to campus. One major factor, though, is the "critical mass" of DL courses since students may prevent travel to campus in one course but have several other courses that require travel. Safety and convenience for non-traditional students also will affect the choice of DL courses.

Data used in this study are limited in scope and suffer from the bias of "self-report" rather than objective measures. Important questions remain, including: Do students cut total travel as a result of reduced travel or does it stimulate other travels? Do these changes persist over time? Longitudinal data will help to address these questions more systematically.

As the need for ongoing knowledge management and lifelong learning grows, so will the need for alternative delivery methods. In an increasingly complex world, access to education

anytime and anywhere heightens the demand for virtual mobility through distance learning. As DL offerings continue to expand, their influence on travel patterns will become more pronounced.

III. VIRTUAL MOBILITY: TELEWORK

The most discussed example of virtual mobility is telecommuting (also referred to as telework). While telework existed prior to the Internet, and many teleworkers rely on the telephone or stand-alone features of their computers, the advent of the Internet (along with other information technologies) has given a new impetus to telework. Not only is there a higher level of connectivity between companies, suppliers and customers, but also computer and Internet access (and speed) in private homes has seen a tremendous increase, facilitating the technical conditions of telework.

One of the major impacts of the Internet on work and lifestyle is that it affects public policies and personal choices. Employers and unions are concerned about the impact telecommuting has on productivity (Rooney, 1999) and human resources (Lomo-David, and Griffin, 2001; Rasmusson 1999). Workers address its impact on family wellbeing (Hill and Hawkins, 1996; Hill et al. 2001), and policy makers discuss its impact on transportation patterns (Mokhtarian, 2000). Overall, telecommuting is expected to lessen the impact of automobile travel on pollution and congestion while possibly having a beneficial impact on consumer spending and time use. An increase in telework may thus have desirable ecological consequences. Part of our research addresses factors increasing the likelihood of telecommuting. Though the literature on telecommuting has grown in recent years, little research has focused on its transportation impact. One exception is Mokhtarian's work (e.g. Mokhtarian and Salomon, 1997).

Mokhtarian (1997) found that miles saved by telework outweighed, by far, additional travel generated by telecommuters. Despite the considerable potential for trip reduction, the overall impact is limited due to the small fraction of teleworkers as a percentage of the total population. Furthermore, telecommuting tends to be primarily part-time, usually one or two days/week. For typical teleworkers, 25 or 30 percent of work related travel is eliminated rather than 80 or even 100 percent. She reports a savings of 31 vehicle miles traveled per telecommuting occasion. Mokhtarian (2002) projects an overall savings potential of less than one percent of vehicle miles through reduced travel resulting from telework. This effect, however, could become stronger with increased telework adoption. It is also more pronounced in areas with higher concentrations of teleworkers. Xiao et al., (unpublished) explored factors facilitating adoption of telework. Their findings indicate that work time flexibility, employer encouragement, educator as the occupation, having access to Internet at home, using computers longer than one hour a day, having more computers at home, and perceiving that Internet use can reduce travel time to work and shopping are positively related to actual or intended Internet substitution for travel to work.

Cultural and social differences may make telework less desirable in some countries. Gärling, Gärling and Johansson (2000) assessed options for car-use reduction measures in Swedish households. Trip chaining and choice of closer venues was preferred for shopping and leisure activities while for work, alternatives such as biking and public transit were chosen. Subsequent travel diaries, however, revealed a lower level of reduction in car-use than originally

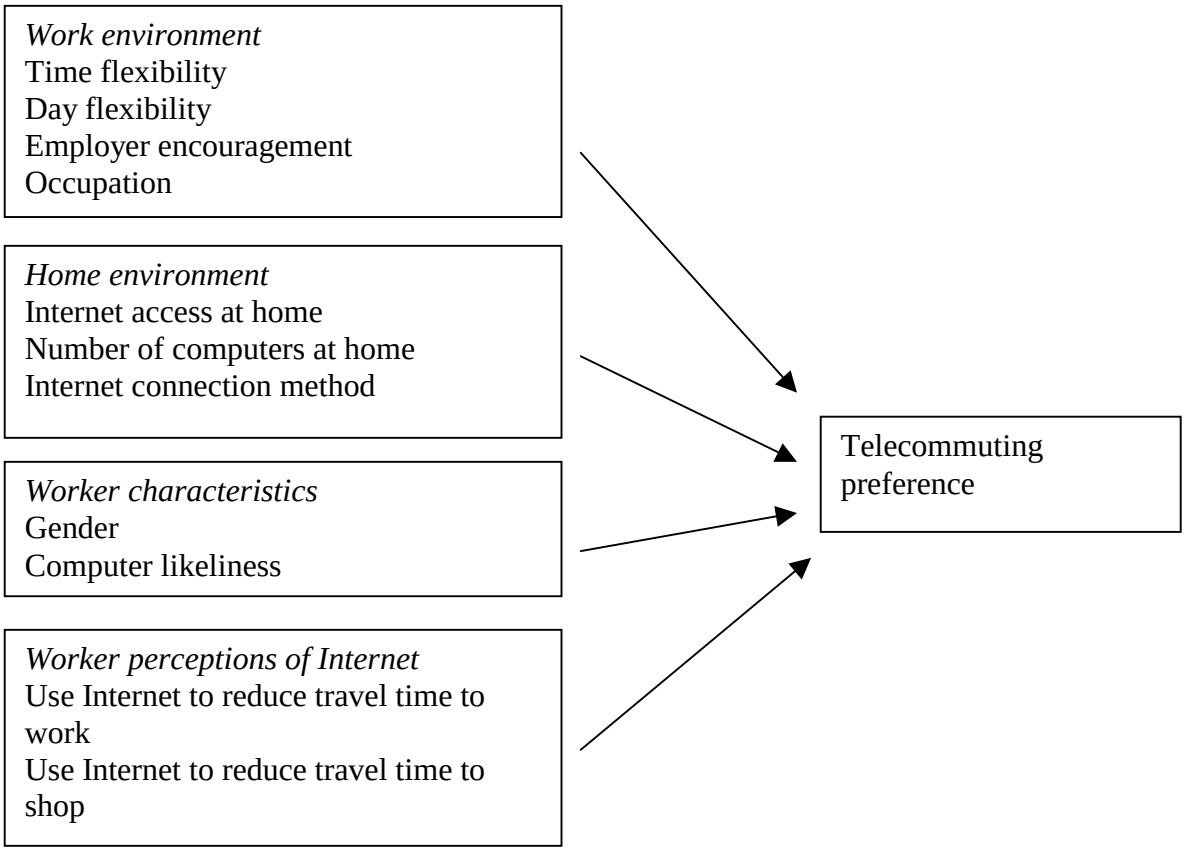
expected. Shopping and leisure trips, often not planned far in advance, are especially less likely to be subject to rationalization measures.

TELEWORK CASE STUDY

Hypotheses

While telecommuting is technically feasible and ecologically desirable in many communities, its practice is still limited. Preference for telecommuting may be affected by a number of variables. Based on the literature, we have identified four sets of variables, which may affect workers' telecommuting preference: work environment, home environment, worker characteristics and perceptions of Internet impact on time use. Workers in work and home environments that encourage and facilitate telecommuting, that contain characteristics that are in favor of telecommuting, and that have expectations of Internet-related time savings would be more likely to telecommute (Figure 1).

Figure 1. Conceptual Map



Work Environment

Facilitators in the work environment could include job suitability, employer encouragement, and flexible work times and days. The following hypotheses are based on the literature:

H1: Workers whose work time is more flexible are more likely than those with less flexible work time to telecommute.
H2: Workers who work fewer days per week are more likely than those who work more days per week to telecommute.
H3: Workers whose employers encourage telecommuting are more likely than others to telecommute.
H4: Workers in professional and managerial occupations are more likely than those in clerical occupations to telecommute.

Hypotheses 1 and 2 are based on work flexibility. Flextime is broadly defined as the ability to rearrange one's work hours within certain guidelines offered by the company (Hill, et al., 1996). Research indicates that employees with flextime are more satisfied with their jobs, more likely to want to remain on the job, and show more initiative than workers with no access to these policies (Galinsky and Johnson, 1998). Perceived job flexibility is related to improved work-family balance (Hill et al., 1996). Workers in a company allowing flextime may be more likely to telecommute.

Hypothesis 3 is self-explanatory. Some major American companies are encouraging telecommuting to enhance productivity, improve profits, and remain competitive (Lomo-David and Griffin, 2001). The amount of telecommuting permitted by the job has a positive effect on the telecommuting preference (Mokhtarian and Salomon, 1997).

Hypothesis 4 describes some occupations as potentially being more suitable than others for telecommuting. A study conducted in California investigated perceived drives and constraints of telecommuting by various occupations (Mokhtarian, Bagley, and Salomon, 1998). The findings include: clerical workers are more likely than managers or professionals to see the family, personal, and office stress-reduction benefits of telecommuting as important; and managers and professionals are more likely to cite productivity gain as the most important advantage of telecommuting. Perceived constraints vary for clerical and professional ranks. Misunderstanding, supervisor unwillingness, job unsuitability, risk aversion, and perceived reduced social interaction affect mainly clerical workers.

Professional workers tend to fear household distractions, reduced social and professional interaction, the need for self-discipline, and the lack of visibility to management. Reduced professional interaction and household distractions were found to be key constraints for managers. These findings are difficult to operationalize into a hypothesis that predicts the preference of telecommuting among various occupations. However, a critical factor in telecommuting may be flexible work hours and days. Managerial and professional workers would have a higher level of job flexibility than clerical workers and would thus be more likely to telecommute.

Home Environment

The home environment presents physical, economic, social, and technical dimensions relevant to telework. While the former dimensions are of great importance and relatively stable (except for the influence of business cycles), there is a steady progression in the availability of information technology to private homes, which, in turn, is mediated by socioeconomic factors (Deak, 2004). In this section, we focus on the technical aspect of the home environment.

H5: Workers who have computer access at home are more likely to telecommute than those who lack computer access.
H6: Workers who have more computers at home are more likely to telecommute than those who have fewer computers.
H7: Workers who have faster Internet connections at home are more likely to telecommute than those who have slower connections.

When telecommuting has been studied previously, studies focused on work-family conflicts, including computer access (Hill, Hawkins, Ferris, and Weitzman, 2001). Without a helpful home computer environment, a worker cannot complete the work well at home. Internet access at home is a prerequisite for telecommuting workers. While there is limited research relating the home computer environment to the likelihood of telecommuting, it may be an important predictor of telecommuting preference. For workers who have a choice to telecommute, technology in the home may facilitate the decision to telecommute. Additional computers at home would have the potential to reduce work-family conflicts when other family members need computers for schoolwork or entertainment. Faster modem connections would reduce stress and frustration resulting from time wasted. By the time of this writing, the level of high-speed Internet access has considerably increased. It might be expected that the number of workers choosing to work at home will eventually follow the technological progress.

Worker Characteristics

In this section, we focus on two worker characteristics that may affect telecommuting preferences: gender and computer skill.

H8: Females are more likely than males to telecommute.
H9: Workers who use computers more hours a day are more likely to telecommute than those who use them fewer hours.

Hypothesis 8, focusing on gender differences, originates in several studies. No study has documented gender difference in the telecommuting preference. However, there is gender difference when drives and constraints of telecommuting are examined. On average, women rate the advantages of telecommuting more highly than men. Women are more likely than men to have family, personal benefits, and stress reduction as potential motivations for telecommuting, and are more likely to possess the constraints of supervisor unwillingness, risk aversion, and concern about lack of visibility to management (Mokhtarian, Bagley, and Salomon, 1998). Some scholars argue that women may be more likely to telecommute since they have multiple work and family roles compared to their male counterparts (Mokhtarian and Salomon, 1997).

Hypothesis 9 uses length of time using a computer at home as an indicator of worker's computer skills. A typical telecommuter usually works at home one or two days a week. If a worker uses computers longer than other workers at home everyday, we consider this person as having more computer skills than others and thus is more likely to telecommute.

Perceptions of Internet Impact

The perceptions of positive telecommuting experiences could help workers form telecommuting preferences. In this section, we focus on two perceptions, the perceived telecommuting effects on saving work- and shopping-related travel time.

H10: Workers who perceive that using the Internet will save travel time to work are more likely than others to telecommute.
H11: Workers who perceive that using the Internet saves travel time to shopping locations are more likely than others to telecommute.

Attitude variables play an important role in telecommuting choices. In a study of telecommuting preferences, researchers have used attitudinal variables to form various drives and constraints and these variables showed significant effects (Mokhtarian and Salomon, 1997). In the current study, attitude variables are perceptions of Internet impact on time use for travel to work and shop. We consider saving work and shopping travel time by using the Internet as having benefits for workers. Thus, the perceptions should be positively related to the telecommuting preference.

Survey of Telework

Survey Method and Sample

In 2001, two surveys were conducted in southern Rhode Island, United States. The first survey was conducted among local residents. A list of 5000 names was obtained from the mailing list service of *Providence Journal Bulletin*, the major newspaper in Rhode Island. A four-page questionnaire was mailed to the respondents in January 2001, and 925 questionnaires were returned with a response rate of 18.5%. In April 2001, the same questionnaire was sent to 2,600 University of Rhode Island employees and 780 usable questionnaires were returned for a response rate of 30%. Both samples were combined for analysis.

The combined data set has 1,705 observations. In this project, we focused on people who were employed outside the home. Further, we excluded observations that have missing values in variables used for this study and those who said they were telecommuters at the time of the survey but reported that they did not have access to the Internet and did not have a computer at home. A final sample size of 1,182 resulted.

The focused variable in this study was use and intention to use the Internet to substitute for travel to work. Behavior change theory states that people's behavioral change is a multi-stage process, involving precontemplation, contemplation, preparation, action, and maintenance (Prochaska, Redding, and Evers, 1996). Therefore, change occurs step by step. To capture some of these stages, the following questions were used:

(1) Do you use Internet/World Wide Web to AVOID traveling to work now?
(2) If NO, what are your intentions for the future?
(3) If YES, how long have you been doing it?

Based on the information collected from the above questions, we divided the respondents into three groups, those who do not intend to substitute the Internet for travel [n=1053], those who intend to do so [n=50], and those who currently substitute the Internet for travel to work

[n=79]. We labeled the three groups as "no change," "intend to change," and "substituters," respectively.

Independent variables included number of work days per week, perceived work time flexibility (0-no flexibility, 9-complete flexibility), if the employer encourages telecommuting, occupation, access to Internet at home, number of computers at home, Internet connection method, gender, time spent using the computer at home, perceived Internet impact on travel time to work and shopping.

The occupation variable had five categories: managerial/professional, office/clerical/sales, educator, technical/skilled, and other. Because the data were collected in an area where a university is located, educator refers to a higher education setting. University educator can be considered as a special category of professional occupation in terms of greater job flexibility, and might be considered a lead user group.

Chi-square tests were used to test if there were any associations between the dependent variable (Internet substitution for transportation) and independent variables. Multilevel logistic analysis was conducted, in which the Internet substitution for travel variable was the dependent variable, to examine if independent variables that showed associations with the dependent variable still have effects after all independent variables are tested together.

Survey Findings

Chi-Square Results

Table 9 reports results of chi-square tests, which are all statistically significant ($p<.05$).

Work environment. Hypotheses 1 to 4 were supported. Clearly, the respondents who work four or fewer days are more likely to use or intend to use the Internet as a travel substitute. For example, 12% of workers who work four or fewer days a week currently use the Internet to avoid travel to work compared to only six percent of other workers who have to work five or more days a week do so. Workers who have a more flexible work schedule are more likely than those who have fixed or less flexible work schedules to use (13% vs. 5% and 2%) or intend to use the Internet as a substitute (7% vs. 4% and 2%). If the employer encourages telecommuting, the respondents are more likely to use (27% vs. 4%) or intend to use (7% vs. 4%) the Internet to substitute for travel. Managerial and professional occupations are more likely than office, clerical, and sales occupation to substitute Internet for travel (5% vs. 1%). Educators are more likely than those in other occupations to avoid travel by using Internet (16% vs. 1-5%). Educators are, of course, in a unique position in terms of scheduling flexibility and other factors. However, other types of ‘knowledge workers’ are already following suit (especially those in the telecommunications and IT industries).

Home environment. Hypotheses 5 to 7 were also supported by chi-square tests. Respondents who have access to the Internet at home are more likely than those who do not use (8% vs. 0%) or intend to use (5% vs. 1%) the Internet as a travel substitute. The number of computers at home is positively related to the Internet substitute for travel. The respondents have two or more computers are more likely to use (14% vs. 4% and 0%) or intend to use (6% vs. 4% and 1%) the Internet to substitute for travel to work. Faster speed Internet connection seems positively related to the Internet substitution behavior. Nine percent of respondents who have

cable or other faster connections currently use Internet to avoid travel for work, compared to seven percent of respondents who only have dial-up modem connections.

Worker characteristics. Based on the chi-square tests, Hypothesis 8 is rejected but Hypothesis 9 is supported. Unlike the prediction in Hypothesis 8, male respondents are more likely than females to use (8% vs. 5%) or intend to use (5% vs. 3%) the Internet to avoid travel to work. The more time spent using a computer a day, the more likely respondents are likely to use (14% vs. 6% and 3%) or intend to use (8% vs. 5% and 2%) the Internet for travel substitution.

Worker perceptions. The perceived impact of Internet use on reducing travel time seems positively related to Internet substitution for travel behavior. For example, respondents are more likely to use Internet substitution for travel if they believe that Internet use results in less travel time to work (29% vs. 1-14%) and shopping (13% vs. 3-7%).

TABLE 9. Chi-square results

Variable	No change (%)	Intend to change (%)	Substituter (%)	Chi-square	p
Workdays per week				10.653	0.0308
4 or fewer days	82.61	5.59	11.8		
5 days	89.82	4.35	5.84		
6 or more days	91.84	2.04	6.12		
Work time flexibility				48.1178	<.0001
no flexibility	96.7	1.47	1.83		
less flexible	91.04	3.58	5.38		
more flexible	80.06	7.41	12.54		
Telecommuting is encouraged				18.508	<.0001
No	92.42	3.89	3.69		
Yes	66.67	6.54	26.8		
Occupation				63.8873	<.0001
technical/skilled	90.32	5.65	4.03		
office/clerical/sales	96.65	2.87	0.48		
managerial/professional	90.58	4.04	5.38		
educator	78.52	5.28	16.2		
Other	94.12	3.36	2.52		
Access Internet from home				24.0501	<.0001
No	98.56	1.44	0		
Yes	87.06	4.83	8.11		
Number of computers at home				59.9391	<.0001
None	99.09	0.91	0		
One	92.69	3.65	3.65		
two or more	79.9	6.19	13.92		
Internet connection method				14.0955	0.007
None	96.4	3.6	0		
Modem	88.36	4.9	6.74		
cable and other	88.24	2.35	9.41		
Length of using computer daily				69.73	<.0001
30 minutes or shorter	95.76	1.66	2.58		
31-60 minutes	89.29	5.19	5.52		
61 minutes or longer	77.95	7.55	14.5		
Gender				8.2069	0.0165
Female	91.57	3.24	5.19		
Male	86.37	5.31	8.32		
Perceived impact on travel for work				17.4603	<.0001
more time	71.43	14.29	14.29		
less time	64.29	7.14	28.57		
no change	91.55	3.52	4.93		
not applicable	95.26	4.21	0.53		
Perceived impact on travel for shopping				55.1564	<.0001
more time	85.71	7.14	7.14		
less time	77.81	8.94	13.25		
no change	93.17	2.32	4.51		
not applicable	92.22	4.44	3.33		

Logistic Results

Because chi-square tests only investigate the possible association between two variables, we consider the findings preliminary. Multivariate analyses are needed to examine if the effects still exist when all the possible factors enter into one model. Because the dependent variable is a three-level categorical variable, the multilevel logistic model was used to test the effects of the independent variables. Adjustments were made for several variables. The following variables were used as continuous measured variables: workdays per week and work time flexibility. Each of the perceived Internet impact variables was coded as 1 if using less time perceived. A stepwise variable selection procedure was used in the logistic analysis.

Table 10 presents the logistic analysis results. Three work-related variables (work time flexibility, employer encouragement, educator as an occupation), two computer related variables (having access to Internet at home and using Internet longer than one hour a day), two perception variables (perceived that Internet use reduces time in work related activities and shopping), and one computer variable (number of computers at home) showed positive effects on the behavior of Internet substitution for travel. In other words, respondents who have more flexible work time, are encouraged by the employer to telecommute, are educators by occupation, have Internet access at home, use the Internet more than one hour a day, perceive that Internet use can reduce travel time to work and to shop, have a greater number of computers at home, and are more likely to use or intend to use the Internet to substitute for travel to work. For example, a worker who is encouraged by her/his employer is 325% more likely to telecommute or be willing to telecommute. Compared to office, clerical, and sales occupations, educators are 130% more likely to telecommute or be willing to telecommute. Based on the findings of the logistic analysis, seven (Hypotheses 1, 3, 5, 6, 9, 10, 11) out of eleven hypotheses are supported by the logistic analysis.

TABLE 10. Logistic Results: Factors Associated with Willingness to Telecommute

Variable	Estimated Coefficient	p	Odds Ratio
Intercept	-5.8392	<.0001	
Intercept2	-5.1367	<.0001	
Work time flexibility	0.1069	0.0046	1.113
Telecommuting is encouraged by employer	1.4468	<.0001	4.249
Having access of Internet at home	1.7252	0.0061	5.614
Using computer less 30 minutes or less	-1.3114	<.0001	0.269
Using computer between 31 to 60 minutes	-0.7379	0.0033	0.478
Perceived less time for work because of Internet use	0.4627	0.029	1.588
Perceived less time for shopping because of Internet use	1.1538	<.0001	3.170
Number of computers at home	0.5886	0.0075	1.802
Occupation is educator	0.8313	0.0001	2.296
-2 Log Likelihood	987.145		
Max-rescaled R-Square	0.3161		
Percent Concordant	84.9		
N	1103		

Results from Additional Logistic Analyses

To gain more insights, we conducted three additional binary logistic analyses. The first is to compare no-changers with intend-to-changers, the second is to compare no-changers with telecommuters, and the third is to compare intend-to-changers with telecommuters (Table 11). The results of the first model indicate that flexible work time, time using computer per day, and perceived time savings by using the Internet to substitute for travel to shopping are positively related to those who intend to use Internet to avoid travel to work. The factors in the second model that distinguish between no-changers and telecommuters are employment encouragement, number of computers at home, being an educator, and perceived time saving for travel to work by using the Internet. The findings from the third model indicate that employment encouragement, being an educator, and Internet connection method are distinguishing factors between intend-to-changers and telecommuters.

TABLE 11. Results from Additional Logistic Analyses

	Intend to change (vs. No change)	**User (vs. No change)**	**User (vs. Intend to change)**
Work time flexibility	0.1672		
Telecommuting is encouraged by employer		1.8469	1.5378
Using computer less 30 minutes or less	-1.1665		
Perceived less time for work because of Internet use		1.6720	
Perceived less time for shopping because of Internet use	1.1508		
Number of computers at home		1.1141	
Occupation is educator		1.2726	1.5496
Cable connection			1.4273
-2 Log Likelihood	407	572	172
Max-rescaled R-Square	0.1377	0.3500	0.3027
Percent Concordant	76.4	83.8	69.8
N	1103	1132	129

Note: All findings reported here are statistically significant at 5% or better

TABLE 12. Significant Differences between Groups

	No Intention to Change	Current Telecommuters
Intend to Change	Flexible work time Computer use time per day Perceived time savings of using Internet	Employer encouragement Educators Speed of Internet connection
Current Telecommuters	Employer encouragement Number of computers at home Educator Perceived time savings of using Internet	NA

CONCLUSION FROM TELEWORK CASE STUDY

This study used data collected from a sample of workers in Rhode Island, United States, to examine factors that form the telecommuting preference. Multivariate analyses indicate that work time flexibility, employer encouragement, educator as the occupation, having access to Internet at home, using computers longer than one hour a day, having more computers at home, and perceiving that using the Internet can reduce time travel to work and to shop are positively related to using or intending to use Internet to substitute for travel to work.

One of the four variables that are hypothesized as possible influential variables but not statistically significant is gender. No previous study documented gender differences in the telecommuting preference. In only one study, gender did not show effects, but the authors argue that the gender difference is embedded in other attitudinal variables (Mokhtarian and Salomon, 1997). The same researchers do find gender difference in perceived drives and constraints of telecommuting preferences (Mokhtarian, Bagley and Salomon, 1998). Based on their findings, we speculated that females are more likely than males to telecommute but our chi-square results showed an opposite finding. The result from the logistic analysis showed no significance for this variable. More research could be conducted to clarify this issue in the future.

This study has a number of limitations. First, the sample is drawn from one area in the United States that is not representative of the U.S. population. Second, this is a cross-sectional survey. Panel data may be used to better understand the targeted behavior change. Because of the importance of the topic and because current and limited research focuses on this topic, however, findings will contribute significantly to the literature on this topic.

IV. COMPARING VIRTUAL TRAVEL SUBSTITUTES

Since telework is an established paradigm for traffic reduction, Table 13 compares DL to telework both generally and specifically with regard to traffic.

TABLE 13. Telework and Distance Learning

	Telework	***Distance Learning***
General		
Target group	Management/ Clerical	Students
Payment	Employer	Learner (U.S.)
Initiative	Employer	Learner
Economic goal	Employment reach	Enrollment reach
Behavioral goal	Task completion	Critical thinking
Time frame	Long-term	Finite (semester)
Traffic impact		
Roads affected	Highways	Suburbs
Predictability	High	Limited
Time frame	Year-round	Seasonal
Time of day	Rush hour	Day and night
Time commitment	Part and full-time	DL mostly part-time
Size of potential target	Most knowledge workers	College; Graduate; Corporate

Table 13 illustrates that telework has a larger potential for affecting transportation than DL. In part, the potential exists in the US work force's concentration in the "knowledge workers" category because these workers could work from home. People work many decades longer than they are in school – this also affects telework opportunities. Nevertheless, several million people in the US alone could be involved in DL, which could have a significant traffic impact.

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APPENDIX A

Distance Learning Questionnaire 1

DISTANCE LEARNING QUESTIONNAIRES 1

MKT331-Advertising - Fall 2001

This is a continuation of your opinion regarding WebCT. Please take a few minutes to answer the following questions regarding WebCT and other related issues. Thank you. (Please ✔ for your response)

1. Based on your experiences so far, both in this class and other classes, what are your opinions regarding WebCT?

	Strongly disagree				*Strongly agree*
It is very convenient to access assignments on WebCt.	**1**	**2**	**3**	**4**	**5**
It is very difficult to post/upload files and comments on WebCT.	**1**	**2**	**3**	**4**	**5**
It is very convenient to access tests on WebCT.	**1**	**2**	**3**	**4**	**5**
Overall, I think WebCT is an excellent way of fulfilling college requirements.	**1**	**2**	**3**	**4**	**5**

2. From where did you access WebCT for the test last Friday? Check ✔ only one box.

1From off campus home at URI 2From on campus home (dorm/sorority/fraternity)

3 From home (not at URI) 4 From the library/computer lab 5Other

3. What kind of Internet connection did you have ? (Please ✔ one)

1 Dial-up Modem 2 Cable Modem3 On Campus Network 9 Don't know

4. Did you experience any difficulties <u>accessing</u> the last test?

0**Not at all** 2 **A little** 3 **Somewhat** 4 **A lot** **5A great deal**

5. Did you experience any difficulties <u>completing</u> the last test?

0**Not at all** 2 **A little** 3 **Somewhat** 4 **A lot** **5A great deal**

6. Because of tests on WebCT, are you able to avoid coming to campus on test days?

0No **1Yes**

7. If you were given a choice of taking tests on WebCT or in class, which one would you prefer?

1WebCT **2In Class** **3Indifferent, like both**

8. What is the best thing about using WebCT?

_____
_____
_____

9. What is the worst thing about using WebCT?

_____
_____
_____

MKT331-Advertising - Fall 2001 **Your Network ID?_ _ _ _ _ _ _ _**

This is a continuation of your opinion regarding WebCT. Please take a few minutes to answer the following questions regarding WebCT and other related issues. Thank you. (Please ✔ for your response)

1. **Based on your experiences so far, both in this class and other classes, what are your opinions regarding WebCT?**

	Strongly disagree				***Strongly agree***
It is very convenient to access assignments on WebCt.	**1**	**2**	**3**	**4**	**5**
It is very difficult to post/upload files and comments on WebCT.	**1**	**2**	**3**	**4**	**5**
It is very convenient to access tests on WebCT.	**1**	**2**	**3**	**4**	**5**
Overall, I think WebCT is an excellent way of fulfilling college requirements.	**1**	**2**	**3**	**4**	**5**

2. **Please check all the days of the week that you have classes this semester?**

1 Monday 2 Tuesday 3 Wednesday 4 Thursday 5 Friday

3. **As a result of WebCT, how many <u>days per week</u> did you AVOID coming to campus?**

0 Zero days 1 1/week 2 2/week 3 3/week 4 4/week 5 5/week

4. **If zero days, what were the reasons for coming to campus even when WebCT was available for this class? Check ✔ as many as applicable.**

1 Other Courses **1** Library/Assignments **1** Other Activities **1** Work on campus

5. **Compared to Spring and Fall semesters last year, did your <u>travels to campus</u> increase, decrease or remain unchanged this semester (Fall 2001)?** 1 Increased 2 Decreased 0 Unchanged

6. **Compared to Spring/Fall semesters last year, how have the following activities changed *for you* this semester?**

In comparison to last year,	***Less than last year***		***No Change***		***More than last year***
The number of classes per week this semester is ...	**1**	**2**	**3**	**4**	**5**
Use of WebCT by course instructors this semester is …	**1**	**2**	**3**	**4**	**5**
My participation in non-course related campus activities this semester is	**1**	**2**	**3**	**4**	**5**
Course related group work and other assignments that require my travel to campus is ….	**1**	**2**	**3**	**4**	**5**
My carpooling with friends/roommates is ..	**1**	**2**	**3**	**4**	**5**

7. **For the last test remaining in this course, if a choice was available of taking the entire test on WebCT or in class (assuming it is also an open book test), which one would you <u>prefer</u>? Check ✔ only one box.**

1 Prefer WebCT 2 Prefer In Class 3 Indifferent, like both

8. **What are the primary reasons for your preference (as stated above in Q.8)?**

	Strongly disagree				***Strongly agree***
Convenience of WebCT is greater	**1**	**2**	**3**	**4**	**5**
Pressure and tension of in-class test is greater	**1**	**2**	**3**	**4**	**5**
Easier to consult book/friends on WebCT	**1**	**2**	**3**	**4**	**5**
Can avoid traveling to campus because of WebCT	**1**	**2**	**3**	**4**	**5**

9. **From where did you access WebCT for the test last Friday (Nov 16)? Check ✔ only one box.**

1 From off campus home at URI 2 From on campus home (dorm/sorority/fraternity)
3 From home (not at URI) 4 From the library/computer lab 5 Other

Name:

APPENDIX B

Resident Questionnaire Wave 1:
Attitudes toward Transportation and Technology

Resident Questionnaire Wave 1: Attitudes towards Transportation and Technology

RI⊞IM

SEQ. NO: _ _

OPINIONS & BELIEFS

1. When you think about RI today and in the near future, how concerned are you with each of the following issues? Would you say you are extremely concerned…not at all concerned? Please mark one for each statement.

	Extremely concerned				***Not at all concerned***
Growth in traffic congestion	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Having enough good jobs	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Conditions of existing roads and highways	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Bringing more business to Rhode Island	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Having good public transportation	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Maintaining and improving our quality of life	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Protecting community character	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑

2. **Please tell us your degree of agreement or disagreement with each of the following statements**.

Please mark one for each statement.

	Strongly disagree				***Strongly agree***
My involvement in environmental activities today will help save the environment for future generations	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
My community is better off today than it was before	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
The road system today is more than capable of handling the traffic volume in my community than before	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
Economic growth should take precedence over environmental considerations	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
We should promote new development that mixes residential, retail and office uses	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
We should increase open space and recreation areas EVEN IF taxes increase	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
There are too many restrictions placed on residential construction in my community	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
The amount of energy I use does not affect the environment to any significant degree	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
There is nothing the average citizen can do to help stop environmental pollution	1 ❑	2 ❑	3 ❑	4 ❑	❑

3. The following statements express how some people feel about life in general. Please indicate your agreement or disagreement with each of the statement. Please mark one for each statement.

	Strongly disagree				***Strongly agree***
In most ways my life is close to my ideal	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
I am satisfied with my life	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
So far I have gotten the important things I want in life	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
If I could live my life over, I would change almost nothing	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
I like to continue doing the same old things I want in life	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
I like a job that offers change, variety, and travel, even if it involves some danger	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
I am continually seeking new ideas and experiences	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑
I would not car pool unless I was forced to. It is too inconvenient	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑

B. TRAVEL BEHAVIORS

4. Which method of transportation do you *use most* when: (Please mark one only for each travel)

	Walk	**Bike**	**Own Car**	**Carpool**	**Bus**	**Train**	**Boat**	**Not Appli-cable**
Traveling to work?	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑	6 ❑	7 ❑	9 ❑
Traveling for shopping?	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑	6 ❑	7 ❑	9 ❑

5. Are you currently employed outside the home?

1❑ Yes (continue) 0❑ No (☞skip to 16)

5a. How many days a week do you work outside the home? (Please mark one only)

1❑ 2❑ 3❑ 4❑ 5❑ 6❑ 7❑ days/week 0❑ No regular schedule

6. How much flexibility do you have regarding *the time* when you must travel to work? (Please Circle one)

No flexibility at all 0…..1…..2……3…..4…..5…..6…..7…..8…..9 Complete flexibility

7. *On a typical work day,* how long does it take to reach your work place?

_____ hour(s) _____ minutes

8. What is the approximate distance (in miles) from your home to your work?

_____ number of miles 99❑ Don't know

9. Which of the following main roads do you use to travel to work? (Please mark as many as applicable**)**

1❑ Rt 1 1❑ Rt.2 1❑ Rt.3 1❑ Rt 4 1❑ Rt 5 1❑ Rt 6

1❑ Rt.10 1❑ Rt 95 1❑ Rt 102 1❑ Rt.108 1❑ Rt 112 1❑ Rt 113 1❑ Rt.117 1❑ Rt.138 1❑ Rt.146 1❑ Rt 195 1❑ Rt 295 1❑ Other

10. How much flexibility do you have regarding *the route* you travel to get to your workplace? (Circle one)

No flexibility at all 0.….1…..2…..3…..4…..5…..6…..7…..8…..9 Complete flexibility

11. Do you carpool or use public transportation to travel to work *now*?

0❑ No (continue) 1❑ Yes: (skip to 11b)

11a. If NO, what are your intentions for the future? (✔❑ one only)

0❑ I DO NOT intend to carpool or use public transportation in the next 12 months
1❑ I DO intend to carpool or use public transportation in the next 6 months
2❑ I DO intend to carpool or use public transportation within the next 3 months

11b. If YES, how long have you been doing it? (mark one only)

3❑ I have been carpooling or using public transportation for the past 3 months
4❑ I have been carpooling or using public transportation for more than 3 months

12. How likely are you to use car pool or public transportation if any of the following changes occurred?

	Please choose 1 for each statement.					
It is _____that I would use carpool/ bus/ bicycle if…	*Very Likely*				*Very unlikely*	*Not App/Don't Know*
Special carpool lanes on I-95/I-195	1❑	2❑	3❑	4❑	5❑	9❑
Higher parking fees	1❑	2❑	3❑	4❑	5❑	9❑
Lower bus fares	1❑	2❑	3❑	4❑	5❑	9❑
Easily available bus schedules	1❑	2❑	3❑	4❑	5❑	9❑
Safe bike paths	1❑	2❑	3❑	4❑	5❑	9❑
Easy-to-create car pools	1❑	2❑	3❑	4❑	5❑	9❑
Lower bridge and highway tolls	1❑	2❑	3❑	4❑	5❑	9❑
Discounts on gas & other items for using carpools/public transports/bicycles	1❑	2❑	3❑	4❑	5❑	9❑

13. Do you have to pay for parking at your job site?

1❑ Yes 0❑ No 9❑ Not Applicable

14. Is telecommuting encouraged in your workplace? (use phone/computer to complete work from home instead of the office)?

1❑ Yes 0❑ No (skip to 15)

If Yes, do *you* telecommute now?

1❑ Yes 0❑ No

15. How would you describe your place of work/employer?

Type of organization**:** 1❑ Private 2❑ Government 3❑ Non-Profit

Size of organization: 1❑ < 10 employees 2❑ 10-25 employees 3❑ 26-49 employees

4❑ 50-99 employees 5❑ 100-249 employees 6❑ over 250 employees

C. COMPUTER & TECHNOLOGY USE

16. Do you currently access the Internet or World Wide Web?

1❑ Yes (skip to 17) 0❑ No

16a. If No, are you interested in using the Internet/World Wide Web?

0❑ No intention to use Internet in the future (skip to 21 - Demographics)

1❑ Yes, I intend to use Internet in the future (skip to 21 - Demographics)

17. Where do you currently access the Internet/World Wide Web from? (mark as many boxes as are applicable**)**

1❑ Work site 1❑ At home/dorm/fraternity/sorority

1❑ Mobile 1❑ School/Public library

1❑ Internet Café/public location 1❑ Other

18. On an average day, how many <u>minutes</u> do you spend on the Internet/World Wide Web? (mark one only)

1❑ 1 - 30 mins. 2❑ 31 - 60 mins. 3❑ 60 - 90 mins 4❑ 90 - 120 mins

5❑ 2 – 3 hours 6❑ 4 - 6 hours 7❑ over 6 hours 9❑ Don't know

19. We want to know if there has been any change in the amount of time you spend on various activities since you started using the Internet. Are you spending more time/ less time or has there been no change in the following set of activities?

	(mark one box only for each activity)			
Since I started usingInternet/WWW, I ….>	***Spend more time now than before***	***Spend less time now than before***	***No Change***	***Not Appli-cable***
Talking on telephone, including long distance calls?	1❑	2❑	3❑	9❑
In the library or bookstore?	1❑	2❑	3❑	9❑
Watching TV/ videotapes/DVD?	1❑	2❑	3❑	9❑
Traveling for school related activities?	1❑	2❑	3❑	9❑
Traveling for work related activities?	1❑	2❑	3❑	9❑
Traveling for shopping activities?	1❑	2❑	3❑	9❑
Traveling for social activities such as visiting friends, clubs, restaurants?	1❑	2❑	3❑	9❑

20. Do you use Internet/World Wide Web to AVOID traveling to work now?

0❑ No (continue) 1❑ Yes (skip to 20b)

20a. If NO, what are your intentions for the future? (mark one only)

0❑ I DO NOT intend to use Internet/WWW to avoid travel to work in the next 12 months
1❑ I DO intend to use Internet/WWW to avoid travel in the next 6 months
2❑ I DO intend to use Internet/WWW to avoid travel within the next 3 months

20b. If YES, how long have you been doing it? (mark one only)

3❑ I have been using Internet/WWW to avoid travel for the past 3 months
4❑ I have been using Internet/WWW to avoid travel for more than 3 month

D: DEMOGRAPHICS (ABOUT YOURSELF)

21. What is your sex? 1❑ Male 2❑ Female

22. What is your age? 1❑ 18-24 2❑ 25-34 3❑ 35-44
4❑ 45-54 5❑ 55-64 6❑ 65 or above

23. Including yourself, how many people live in your household?
❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 or more

24. What is the highest level of schooling you have completed? (Please mark one)
1❑ Less than High School 2❑ High School 3❑ Vocational School
4❑ Some College 5❑ College Graduate 6❑ Graduate School

25. What is your current occupation? (Please mark one)
1❑ Homemaker 2❑ Student 3❑ Unskilled/Laborer 4❑Technical/Skilled 5❑ Office/Clerical/Sales 6❑Managerial/Professional 7❑ Educator 8❑ Other
9❑ Retired

26. What is your total annual gross household income level? (Please mark one)
1❑ $15,000 or under 2❑ $15,001 – 25,000 3❑ $25,001 – 35,000
4❑ $35,001 – 50,000 5❑ $50,001 – 100,000 6❑ $100,001 or above

27. How long have you lived at this address? (Please mark one)
1❑ Less than 6 months 2❑ 6 – 12 months 3❑ 1 – 2 years
4❑ 3 – 5 years 5❑ 6 – 9 years 6❑ 10 years or more

28. Number of vehicles in your current household:
0❑ none ❑ 1 ❑ 2 ❑ 3 ❑ 4 or more

29. How many computers do you have <u>at home</u>?
0❑ None ❑ 1 ❑ 2 or more

30. What kind of Internet connection do you have currently? (Please mark as many as applicable)
1❑ Dial-up modem 2❑ Cable modem 3❑ ISDN 4❑ DSL 5❑Ethernet
9❑Don't know 0❑ No Internet connection

31. What is your home 5-digit zip code? __/__/__/__/__/

AN INVITATION

We would like to invite you to join a panel of RI residents to help us further on issues of transportation and community. The panel will be contacted over the next 12 months. We will offer attractive prizes to panel participants in random drawings. If you are willing to help, please provide us with your contact information:

❑ **YES, I would like to become a member of the RITIM-URI Transportation Research Panel.**

NAME: _____
LAST FIRST

ADDRESS: _____
NO. STREET APT. NO.

_____
TOWN STATE ZIP CODE

❑ **NO, I would not like to become a member of the RITIM-URI Transportation Research Panel.**

THANK YOU VERY MUCH FOR YOUR TIME & RESPONSES

APPENDIX C

Wave 3 Questionnaire

Wave 3 Questionnaire

RITIM

SEQ. NO: _ _

A. GENERAL OPINIONS

2. How concerned are you that the new Convocation Center at URI will impact your own travel patterns?
Extremely concerned 0……1……..2…….3……...4……...5 *Not at all concerned*

3. How much of your travel patterns are affected by the summer beach traffic in South County?
Not at all 0……1……..2…….3……...4……...5 *A great deal*

B. TRAVEL & WORK BEHAVIORS

3. Are you currently employed outside the home? 1❑ Yes (continue) 0❑ No (skip to Section C below)

4. Which method of transportation do you <u>use most</u> when traveling to work**:** (Please one only)

Walk	Bike	Own Car	Carpool	Bus	Train	Boat	Not Applicable
1 ❑	2 ❑	3 ❑	4 ❑	5 ❑	6 ❑	7 ❑	9 ❑

4a. Do you carpool to travel to your regular workplace?
0 never 0 once a month or less 0 2-3 times a month 0 once a week 0 2-3 times a week 0 daily

4b. Do you use public transportation to travel to your regular workplace?
0 never 0 once a month or less 0 2-3 times a month 0 once a week 0 2-3 times a week 0 daily

C: SHOPPING & BANKING BEHAVIORS

5. How far (driving time) is the shopping mall that you <u>go to most</u> from where you live?
❑ less than 15 minutes ❑ 15 – 29 min. ❑ 30 – 44 minutes ❑ 45 minutes or more

6. Which method of transportation do you <u>use most</u> when traveling for shopping?: (Please one only)
1 ❑Walk 2 ❑Bike 3 ❑Own Car 4 ❑Carpool 5 ❑Bus 6 ❑Train 7 ❑ Boat

9 ❑Not Applicable

7. To what extent do you use the following methods for your shopping? Please ✔ for your response.

	Do not use at all	*Use Somewhat*			*Use Extensively*
Through visits to stores	0	1	2	3	4
By mail order	0	1	2	3	4
By phone order	0	1	2	3	4
By using the computer	0	1	2	3	4

8. In your opinion, how many shopping trips do you save by using phone, online OR catalog shopping?

❑ none ❑ one trip a month or less ❑ 2-3 trips a month ❑ one trip a week ❑ 2-3 trips a week

9. Which of the following items have you purchased from any online service or Internet or World Wide Web site? Check as many as applicable.

1 Books 1 Food 1 Music CDs 1 Clothes 1 Computer hardware
1 Stocks 1 Toys 1 Computer software 0 Did not buy any of above items online

10. In addition to banking in person, we have a choice of banking via the Internet/WWW. Please indicate

YOUR opinion on in-person and online banking below.

Banking in this way is/would be:	***In person, visiting a bank*** Not at all ……To a high degree	***Online, using Internet/Web access*** Not at all ……To a high degree
Efficient	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Satisfying	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Convenient	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Easy	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Expensive	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Difficult	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Fun	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Intimidating	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Rewarding	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Enjoyable	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Secure	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Fast	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5
Personable	1……...2…..…..3……...4……5	1……...2…..…..3……...4……5

11. **For each of the following banking/investment/tax functions, please indicate the option you use most.** Please pick one option for each function.

Banking/Investment Function:	***In Person***	***ATM***	***By Mail***	***By Phone***	***Via Internet***
Get cash	0	1	2	3	4
Transfer funds between accounts	0	1	2	3	4
Check account balances	0	1	2	3	4
Pay bills	0	1	2	3	4
Information about investments	0	1	2	3	4
Paying taxes	0	1	2	3	4

12. How far (driving time) is your trip to the bank?

❑ less than 15 minutes ❑ 15 – 29 min. ❑ 30 – 44 minutes ❑ 45 minutes or more

13. In your opinion, how many trips to the bank do you save by using phone or online banking?*

❑ none ❑ one trip a month or less ❑ 2-3 trips a month ❑ one trip a week ❑ 2-3 trips a week

14. How important are the following statements for your use of online banking ?

	Not at all important		***Some-what***		***Very Important***
I don't have to wait in line	0	1	2	3	4
I don't have to go to the bank so often	0	1	2	3	4
I don't have parking problems	0	1	2	3	4
I can access my account at any time	0	1	2	3	4
I have to drive less	0	1	2	3	4

THANK YOU VERY MUCH FOR YOUR TIME & RESPONSES

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