Using Technology to Promote Postsecondary Success and Savings

An Evaluation of the University of Texas at Tyler’s PATSS Initiative

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Sponsored by the University of Texas at Tyler
Preface

In 2013, the University of Texas at Tyler (UTT) began the implementation of the Patriots Accessing Technology for Savings and Success (PATSS) initiative, which seeks to increase the use of online technologies for instruction. The distinguishing feature of PATSS courses is the use of hybrid instruction, whereby a portion (a third, half, or two-thirds, depending on the course) of a course’s classes are held face-to-face, while the remaining portion are provided asynchronously, generally via pre-recorded videos accessible online. UTT faculty members who teach PATSS courses are required to attend an extensive training on how to create effective online material and have access to trained instructional designers to help develop their hybrid courses.

UTT asked the RAND Corporation to evaluate the PATSS program and examine whether it was indeed meeting the objectives of providing high-quality, flexible courses while improving student outcomes and reducing costs. Our evaluation methodologies included a quasi-experimental, quantitative impact evaluation; a series of qualitative evaluations that informed continuous improvement over the four years of the study; and a cost-benefit analysis that can be used to assess the efficiency and distributional impacts of the program.

This report presents findings from RAND’s evaluation of UTT’s PATSS program. The report should be of interest to postsecondary administrators and faculty interested in leveraging technology to either improve student learning or achieve cost savings—or both—for students and other stakeholders. The report should also be of interest to the postsecondary research community and to policymakers interested in innovations in postsecondary education.

This study was undertaken by RAND Education and Labor, a division of the RAND Corporation that conducts research on early childhood through postsecondary education programs, workforce development, and programs and policies affecting workers, entrepreneurship, financial literacy, and decisionmaking.

RAND conducted this research in collaboration with American Institutes for Research and UTT. This research was funded by UTT through a grant from the University of Texas System. More information about RAND can be found at www.rand.org. Questions about this report should be directed to rdossani@rand.org, and questions about RAND Education and Labor should be directed to educationandlabor@rand.org.
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Summary

In 2013, the University of Texas at Tyler (UTT) began the implementation of the Patriots Accessing Technology for Savings and Success (PATSS) program, an initiative that seeks to increase the use of online technologies for teaching instruction. The distinguishing feature of PATSS courses is that they use hybrid instruction, whereby between one-third and two-thirds of a course’s classes are held face-to-face, while the remaining portion is provided asynchronously online. PATSS instructors are pre-trained to create and deliver effective online material.

Hybrid course instruction has the potential to deliver the best of both worlds when compared with either a fully face-to-face course or a fully online course, as it may allow students and faculty more flexibility when they receive and prepare the online lectures, while preserving the benefits of in-person, real-time interaction between faculty and students. As the primary four-year university in a large and mostly rural region, UTT also sought to expand robust postsecondary opportunities for students in more remote parts of the region, while limiting their need to commute to campus.

UTT asked the RAND Corporation to evaluate the PATSS program and examine whether it was indeed meeting the objectives of providing high-quality, flexible courses while improving student outcomes and reducing costs. We used several evaluation methodologies: a quasi-experimental, quantitative impact evaluation; a series of qualitative evaluations that informed continuous improvement over the four years of the study; and a cost-benefit analysis that can be used to assess the efficiency and distributional impacts of the program. This report describes these evaluations in detail and summarizes our conclusions and recommendations.

Overview of the Study

Quasi-Experimental Impact Evaluation of PATSS

In order to estimate the impacts of PATSS courses on UTT students, we designed a quasi-experimental impact evaluation that used student course-level administrative data that are routinely collected by the university. The main outcomes we considered were students’ course grades, their grades in follow-on courses to PATSS courses, and their stated opinions in the end-of-course survey questions. Our empirical strategy allowed us to estimate the impact of PATSS in comparison to face-to-face courses by looking at the same faculty member who teaches the same course over time as those courses transition from one course modality to the other. This technique is known as a fixed effect, or within estimator, as it examines the correlation between students’ learning outcomes and the course modality within a given faculty member’s course. As long as faculty are not able to choose which modality to teach and they use the same evaluation system under both course modalities, this fixed effect model closely mimics the gold standard of a randomized controlled trial.
**Qualitative Data for Continuous Improvement**

Our study identified areas in need of improvement that could be addressed as UTT continues to implement and refine the program. In various years, we conducted focus groups with students, faculty, and instructional designers, and fielded surveys of students and PATSS faculty members.

At the end of each project year, we used our findings to develop recommendations for improving the implementation of PATSS. These were shared during annual engagement sessions with UTT faculty and administration.

**Estimation of the Costs of PATSS for Students, Faculty, and the Institution**

We developed a cost-benefit model that identified the impacts of PATSS on all stakeholders and quantified and monetized those impacts when possible. The main non-monetizable impacts are the differential gains in knowledge of students in PATSS courses compared with those in face-to-face courses and the preferences of faculty and students for the hybrid versus face-to-face course modality. Therefore, we can consider the monetized net benefits as the trade-off for these non-monetized impacts.¹

**Limitations**

The main limitation in our ability to identify the impact of the PATSS program on UTT students is that we lack data on student outcomes other than course grades and responses to end-of-course survey questions.

The main limitation of the cost-benefit analysis lies in our inability to quantify—and therefore monetize—several of the key program impacts, including student and faculty preferences for the hybrid modality and impacts on future student outcomes. Any conclusions and policy recommendations that are drawn from the cost-benefit analysis must be qualified by recognizing the limited impacts we are able to quantify and monetize.

**Summary of Findings**

In this section, we have highlighted the most-salient findings from our study, drawing from both the qualitative and quantitative results of our work:

- **There was little discernible impact of PATSS courses on student academic outcomes relative to non-PATSS courses.** Our analysis suggests that PATSS had no statistically discernible effect on grades in the PATSS course or in subsequent courses for which the PATSS course was a prerequisite. However, we found that PATSS courses reduced overall grades for 300-level follow-on courses.

  ¹ As we cannot quantify and monetize all of the program impacts, our net benefits estimate could be an under- or an overestimate of the full net benefits of the program.
• **PATSS also had a slightly negative impact on the ratings given by students in student course evaluations.** When their course was taught as a PATSS course, students gave slightly lower overall course and instructor ratings, were less likely to prefer their course format, and were less likely to have known their course format at the time of registration.

• **PATSS provided a net monetizable benefit to all stakeholders of approximately $225,000 annually, or $80 per student per year.** Students experienced a net benefit from reduced commuting while taking hybrid courses. Faculty had net-positive benefits, stemming from negative commuting costs when teaching hybrid courses, but positive course-preparation costs. UTT had substantial net-positive costs, but the most important ones are fixed.

### Data-Driven Refinements to the PATSS Program

Over the course of the study, UTT administrators took a number of actions to improve the implementation of PATSS that were informed by our research and continuous improvement process:

• developed a process to ensure that accurate information on course format is included in the course schedule at the time of registration, and added a tag to UTT course codes that clearly identified PATSS courses

• shifted from PATSS online course material that was delivered as the instructor’s voice over PowerPoint slides, toward professionally produced video lectures broken into digestible pieces

• adapted PATSS training and professional development opportunities to provide more technical training on how to use particular technology and develop pedagogy, and made introductory material optional for experienced PATSS faculty.

### Additional Recommendations for UTT

In 2017, UTT hired a new president, and, as a result, the institution’s focus has shifted away from the PATSS program. However, it is important for the university to leverage the lessons learned from the PATSS experience moving forward. We offer several suggestions:

• More-centralized authority could be useful for future institution-wide reform efforts on the implementation of online learning initiatives. Despite a strong mandate from the former UTT president, the extent of implementation of PATSS varied considerably across academic departments and colleges at UTT, and the administration had little control over whether and to what extent faculty engaged with the program.

• Faculty could benefit from continued professional development opportunities.

### General Findings and Lessons Learned

Over the course of our four-year study and continuous improvement process with UTT, we identified a number of more general findings and lessons learned that may be useful for other
postsecondary practitioners interested in expanding the use of technology in classroom instruction. These include the following:

- Shifting toward hybrid courses can produce savings without harming student performance.
- Reducing commuting needs can produce significant savings for both students and faculty.
- Coordinating course schedules to allow both students and faculty to benefit from reduced commuting needs is challenging.
- Coordinating facilities and classroom space to capitalize on reduced needs can be challenging.
- Achieving faculty buy-in is difficult but crucial.
Acknowledgments

We are extremely grateful to Cindy Strawn at the University of Texas at Tyler (UTT) for providing us the raw administrative data in each semester of this project. We appreciate the many students, faculty, and staff at UTT who have participated in interviews, focus groups, surveys, and engagement sessions. Arwen Bicknell, Rachel Ostrow, and Monette Velasco provided expert editorial and communication support. Catharine Augustine provided helpful feedback on briefings throughout the project, and, on this report, that have helped to improve the research quality and communication of our findings to various stakeholders. Fatih Unlu also provided helpful feedback on this report. Finally, we thank Charles Goldman and David Knight for reviewing this report and providing helpful comments.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AY</td>
<td>academic year</td>
</tr>
<tr>
<td>COA</td>
<td>course of action</td>
</tr>
<tr>
<td>EOC</td>
<td>end of course</td>
</tr>
<tr>
<td>FE</td>
<td>fixed effects</td>
</tr>
<tr>
<td>PATSS</td>
<td>Patriots Accessing Technology for Savings and Success</td>
</tr>
<tr>
<td>UT</td>
<td>University of Texas</td>
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<tr>
<td>UTT</td>
<td>The University of Texas at Tyler</td>
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In 2013, the University of Texas at Tyler (UTT) began the implementation of the Patriots Accessing Technology for Savings and Success (PATSS) program, an initiative that seeks to increase the use of online technologies for instruction. The distinguishing feature of PATSS courses is the use of a hybrid modality, whereby a portion of a course’s classes—a third, half, or two-thirds, depending on the course—is held face-to-face, while the remaining portion is provided asynchronously online, generally via pre-recorded videos accessible online. UTT faculty members who teach PATSS courses are required to attend an extensive training program on how to create effective online material and have access to professional instructional designers to help develop their hybrid courses.

In its strategy document submitted to the University of Texas proposing the PATSS program, UTT described its goals to the PATSS program as developing a “creative, research-based solution designed to create a learning environment that is more accessible and engaging for students and faculty that results in increased learning outcomes, improved retention and cost efficiencies” (UTT, 2013).

The proposal described UTT’s proposed approach to the hybrid modality as a replacement model of redesign by replacing (“flipping”) some lecture time with out-of-class activities that introduce course material to students at their own pace. Students may read course materials online, watch pre-recorded lectures, and/or complete quizzes, exams, and homework online. When students attend class, having been introduced to course content, they can spend time working closely with the instructor to master the material in a PBL [problem-based learning] approach. They may work with the instructor and/or other students on projects, get assistance with difficult concepts, ask questions and more. (UTT, 2013, p. 7)

The hybrid modality may have the potential to deliver the best of both worlds when compared with either a fully face-to-face course or a fully online course, as it may allow students and faculty more flexibility as to when they receive and deliver online lectures, while also preserving the benefits of in-person, real-time interaction between faculty and students.

For the institution, the hybrid modality offers the potential to reduce infrastructure costs, since less classroom space is needed. It could also increase the potential pool of students to include those who require the additional flexibility (Meyer, 2010).

At the same time, there are likely to be significant upfront and ongoing costs and risks that may result from the implementation of the hybrid modality. The costs include not only the infrastructure to set up online learning, chiefly arising from investments in technology infrastructure, but also the instructional costs for both students and faculty of using new technology platforms. There is also the risk that less real-time interaction may reduce the quality of the learning experience (Battaglino, Haldeman, and Laurans, 2012).
There is a rich and growing literature on the effect of online modes of learning in higher education. A meta-analysis of the extant literature in 2009 found that studies on the effect on learning outcomes from online education (both fully online and hybrid modes) showed mixed results (Means et al., 2009). A later study that compared hybrid and face-to-face instruction of a college statistics course in a randomized controlled trial found no difference in student achievement (Bowen et al., 2014). In two different studies of introductory microeconomics courses, Joyce et al. (2014) found no difference in learning after moving to a hybrid mode, while Alpert, Couch, and Harmon (2016) documented a negative impact of moving to full online instruction.

The cost efficiency of online education has been less studied. One study looked at the difference in tuition fees charged by open-access and less-selective institutions offering undergraduate programs in different online modes (Deming et al., 2015). Such institutions accounted for about 59 percent of all U.S. postsecondary enrollments in 2013. Among these institutions, hybrid education is most common in non-selective public-sector institutions. The study found that there is modest evidence of lower tuition fees charged by schools with a higher percentage of students enrolled online. For public-sector institutions, a 10 percent increase in the share of students taking only online courses was associated with a decrease in tuition fees of 1.4 percent. However, the effect of taking hybrid courses and other partially online modalities in public-sector institutions on tuition fees was not significant.

UTT asked the RAND Corporation to evaluate the PATSS program and examine whether it was indeed meeting the objectives of providing high-quality, flexible courses while improving student outcomes and reducing costs. Our evaluation methodologies included a quasi-experimental quantitative impact evaluation, a series of qualitative evaluations that informed continuous improvement over the four years of the study, and a cost-benefit analysis that can be used to assess the efficiency and distributional impacts of the program. This report describes these evaluations in detail and summarizes our conclusions and recommendations.

Overview of the Study

*Quasi-Experimental Impact Evaluation of PATSS*

In order to estimate the impacts of PATSS courses on UTT students, we designed a quasi-experimental impact evaluation that uses student course-level administrative data that are routinely collected by the university. The main outcomes we consider are student’s course grades, their grades in follow-on courses to PATSS courses, and their stated opinions in end-of-course (EOC) survey questions. Our empirical strategy allows us to estimate the impact of PATSS in comparison to face-to-face courses by looking at a faculty member who teaches the

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2 Follow-on courses are those which follow naturally from the preceding course and for which the preceding course is a prerequisite; for example, Intermediate Microeconomics is a follow-on course for Introductory Microeconomics, and a Calculus II course in which integration is taught is a follow-on course for Calculus I (in which differentiation is taught).
same course over time as the course transitions from one modality to the other. This technique is known as a fixed effect, or within estimator, as it examines the correlation between students’ learning outcomes and the course modality within a given faculty-course combination. Under the untestable assumption that faculty are not selectively choosing a course modality to match students’ ability, and the fact that the faculty evaluation process is not affected by course modality, this fixed effect model mimics the gold standard of a randomized controlled trial.

In general, we find little evidence that students’ grades in PATSS courses or their opinions of PATSS courses and professors are meaningfully different from those of students who took the same course in a traditional face-to-face format. On the one hand, this result may seem disappointing to program administrators, in that the hybrid modality did not meaningfully affect students; on the other hand, it is promising to know that the use of a course modality with the potential for significant cost savings results in observably similar student outcomes to traditional modalities.

**Qualitative Data for Continuous Improvement**

In addition to providing rigorous estimates of the impact and costs of the PATSS program, our study also sought to identify areas in need of improvement that could be addressed as UTT implemented and refined the program. To support these efforts, we engaged regularly with UTT administrators and staff and collected a range of qualitative data from students, faculty, and staff. We conducted focus groups with students, faculty, and instructional designers; fielded surveys of students and PATSS faculty members; and added PATSS-related questions to UTT’s regular EOC surveys.

At the end of each project year, we used the findings from these data and our quasi-experimental evaluation to develop a preliminary set of recommendations for improving the implementation of PATSS. During annual engagement sessions with UTT faculty and administration, we shared findings from our quantitative and qualitative analyses and gathered input to help us better contextualize the findings. During those engagement sessions, we also shared our preliminary recommendations for improving the implementation of PATSS and gathered input and suggestions for refining the recommendations. Members of the UTT administration then decided whether and how to act on the interim recommendations.

**Estimation of the Costs of PATSS to Students, Faculty, and the Institution**

The PATSS program affects several different groups of stakeholders, including students, faculty, UTT as an institution, and society at large. For example, hybrid courses—as opposed to fully face-to-face courses—affect student and faculty commuting time, the instructor’s class preparation time, the use of classroom resources, student learning outcomes, and student and faculty satisfaction with the course. Any decision to continue, modify, or discontinue the program should be informed by the impacts on these stakeholders, utilizing the principles of economic efficiency and equity.
We developed a cost-benefit model that identifies the impacts of PATSS on all stakeholders and quantifies and monetizes those impacts when possible. The main non-monetizable impacts are the differential gains in knowledge of students in PATSS courses compared with face-to-face courses and the preferences of faculty and students for hybrid versus face-to-face course modality. Therefore, we can consider the monetized net benefits as the trade-off for these non-monetized impacts.

Our main finding is that, when considering the monetizable impacts, the PATSS program conferred approximately $150,000 per year of aggregate net benefits across all stakeholders. The main benefits accrue to faculty and students participating in hybrid courses, who save time and costs by commuting less often to campus. The main costs include the initial training of faculty to teach and develop hybrid courses, the extra preparation time that faculty must spend developing hybrid courses, and the salaries of the PATSS program staff. An additional cost of the program over the past four years has been the annual evaluation fee of approximately $100,000 paid to RAND each year; this cost would not be incurred in a future steady state, and without the evaluation, the benefits increase to roughly $250,000 per year. The average program savings per student from academic years (AYs) 2014 through 2017 was $80.

Limitations

The main limitation in our ability to identify the impact of the PATSS program on UTT students is that we lack data on student outcomes, other than course grades and stated preferences in responses to the EOC survey questions. For example, we do not observe graduation rates, wages earned after college, or tests of knowledge outside the classroom setting. Such outcomes as graduation rates and wages after college would only be observable several years in the future for most cohorts we study, and, unfortunately, even if these data were available, it would be hard to identify the impact of one or even several PATSS courses on overall performance in college. Furthermore, tests of knowledge are not routinely administered by UTT, but we note that future studies of hybrid course modalities could greatly benefit from the administration of knowledge tests, likely by a research team (as opposed to individual professors).

The main limitation of the cost-benefit analysis lies in our inability to quantify—and therefore monetize—several of the key program impacts, including student and faculty preferences for the hybrid modality and impacts on future student outcomes. Any conclusions and policy recommendations that are drawn from the cost-benefit analysis must be qualified by recognizing the limited impacts that we are able to quantify and monetize.

Organization of This Document

The remainder of this document contains three main chapters and a concluding chapter. We first describe the quantitative impact evaluation of the PATSS program in Chapter 2; then we summarize our data collection and faculty engagement efforts for continual improvement in
Chapter 3; and in Chapter 4 we present our cost-benefit analysis, which estimates and compares the quantifiable and monetizable program impacts on affected stakeholders. Survey instruments can be found in the appendixes.
2. Quasi-Experimental Impact Evaluation of PATSS

In this chapter, we present a quantitative analysis of the impact of hybrid courses on the academic outcomes of UTT students.

Quantitative Approach

Data Sources

Our analysis used data from three sources. First, we used the student course-level files that are required by the State of Texas to be routinely collected by UTT. These files contain one observation for each course taken by each student in every semester; they identify the name and subject of the course, the instructor, and the letter grade the student received, along with limited demographic information, including gender, race, and age. Students and faculty are identified by unique identification numbers, masked for anonymity, which enabled us to merge the data into a longitudinal panel of the population of students over time. We used administrative files from AYs 2012 through 2017, which contained two years of data prior to the introduction of the PATSS program in 2014.3

Our second set of data was provided to us by PATSS administrative staff and contained a list of all courses that were taught in the hybrid modality. We merged this list into our student-course panel, which enabled us to know exactly which courses were and were not in the PATSS program.

Finally, UTT staff provided us with the responses to the EOC survey questions that students are asked to answer after every course. Students are not required to answer these questions, which implies that those that did represent a self-selecting group of students.

Summary of PATSS Courses

Table 2.1 summarizes the PATSS courses offered between AY 2014 and AY2017. The program doubled in size after the first year, increasing from 43 course sections in AY2014 to 86 in AY2015, and then decreased slightly to a steady state of an average of 74 course sections in subsequent years. Courses at UTT are divided into 61 subject areas, and of those, 20 areas had at least one PATSS section at some point between AY2014 and AY2017; we included only these 20 subject areas in our subsequent analyses. In these PATSS subject areas, between 9 and 10 percent of course segments were taught in the hybrid modality in the steady state between AYs

3 Academic years refer to the calendar year of the fall semester; the fall semester of one academic year runs from September to December, and the spring semester of that academic year runs from January to May of the following calendar year.
In total, we observed 277 courses taught as PATSS hybrid courses between AYs 2014 and 2017.

| Table 2.1. Summary of PATSS Courses Offered Between AY2014 and AY2017 |
|--------------------------------------------------|-------------|-------------|-------------|-------------|-------------|
| | Academic Year | 2014 | 2015 | 2016 | 2017 |
|--------------------------------------------------|-------------|-------------|-------------|-------------|
| Number of PATSS courses | 43 | 86 | 75 | 73 | 277 |
| % subject area course taught as PATSS | 5.5% | 10.1% | 9.7% | 9.3% |
| By subject area, percentage (number) | | | | |
| Accounting | 4.5% | 3.8% | 0.0% | 0.0% | 2 |
| | (1) | (1) | | | |
| Health and personal wellbeing | 11.1% | 17.9% | 15.4% | 15.0% | 23 |
| | (4) | (7) | (6) | (6) | |
| Art and art history | 2.2% | 0.0% | 0.0% | 0.0% | 1 |
| | (1) | | | | |
| Chemistry | 0.0% | 0.0% | 0.0% | 8.6% | 3 |
| | | | | (3) | |
| Construction management | 26.7% | 62.5% | 56.3% | 44.4% | 31 |
| | (4) | (10) | (9) | (8) | |
| Criminal justice | 3.4% | 5.1% | 12.5% | 16.2% | 14 |
| | (1) | (2) | (5) | (6) | |
| Education | 4.9% | 13.2% | 2.7% | 4.9% | 10 |
| | (2) | (5) | (1) | (2) | |
| Elementary education | 33.3% | 33.3% | 33.3% | 0.0% | 6 |
| | (2) | (2) | (2) | | |
| English | 2.6% | 6.3% | 3.8% | 1.2% | 11 |
| | (2) | (5) | (3) | (1) | |
| Educational psychology | 0.0% | 50.0% | 0.0% | 25.0% | 6 |
| | | (4) | (2) | | |
| Finance | 4.8% | 10.0% | 0.0% | 0.0% | 3 |
| | (1) | (2) | | | |
| Geography | 0.0% | 0.0% | 0.0% | 8.3% | 1 |
| | | | | (1) | |
| Health and ethics | 28.6% | 30.0% | 0.0% | 16.7% | 6 |
| | (2) | (3) | (1) | | |
| History | 2.6% | 10.3% | 11.4% | 8.0% | 14 |
| | (1) | (4) | (5) | (4) | |
There is a large amount of variation across subject areas and years in the use of PATSS courses. Some subject areas—for example, accounting and reading—offered PATSS courses early on but subsequently discontinued offering PATSS courses. Others, like geography and chemistry, only adopted the hybrid modality later in our study period. The largest coverage of PATSS within any subject area in any year is 62.5 percent—construction management in AY2015—while the smallest coverage is in subjects which offer just one PATSS course in any given academic year. Our understanding is that the variation in the use of the hybrid modality across time and subject is a result of departments (and department chairs) experimenting with this new hybrid modality.

Table 2.2 shows the distribution of PATSS courses across academic levels. The majority of PATSS courses are 300- and 400-level courses, while PATSS is less prevalent in 100- or 200-level introductory courses. This distribution stayed rather steady over the years we studied.
Summary Statistics of UTT Students and Faculty

Sixty-seven unique faculty members taught at least one PATSS segment between AY2014 and AY2017, representing 13.7 percent of all UTT faculty members. Each year, roughly 20 faculty members taught at least one PATSS course, and there was significant faculty turnover in the PATSS program from year to year.

Table 2.3 contains summary statistics of UTT students in AY2012–2017. The average age was 24.5 years, 60 percent were female, and 64 percent were white. On a grade point scale of zero to four, the average grade was 2.97. Only 65 percent of students filled out the EOC evaluation questions. During the years that PATSS courses were offered (AYs 2014–2017), 4.66 percent of UTT students took at least one PATSS course.

Table 2.3. Summary Statistics of UTT Students, AY2012–2017

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
<th># of Students</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>24.58</td>
<td>(7.72)</td>
<td>18,074</td>
</tr>
<tr>
<td>Female</td>
<td>0.60</td>
<td>(0.49)</td>
<td>18,074</td>
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<tr>
<td>White</td>
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<td>Black</td>
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<td>Asian</td>
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<td>18,074</td>
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<tr>
<td>Other race</td>
<td>0.04</td>
<td>(0.21)</td>
<td>18,074</td>
</tr>
<tr>
<td>Total # of Student Courses</td>
<td></td>
<td></td>
<td>139,660</td>
</tr>
<tr>
<td>Grade points</td>
<td>2.97</td>
<td>(1.10)</td>
<td>139,660</td>
</tr>
<tr>
<td>Points =</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (&quot;A&quot;)</td>
<td>0.38</td>
<td>(0.49)</td>
<td>139,660</td>
</tr>
<tr>
<td>3 (&quot;B&quot;)</td>
<td>0.36</td>
<td>(0.48)</td>
<td>139,660</td>
</tr>
<tr>
<td>2 (&quot;C&quot;)</td>
<td>0.16</td>
<td>(0.37)</td>
<td>139,660</td>
</tr>
<tr>
<td>1 (&quot;D&quot;)</td>
<td>0.05</td>
<td>(0.21)</td>
<td>139,660</td>
</tr>
<tr>
<td>0 (&quot;F&quot;)</td>
<td>0.05</td>
<td>(0.23)</td>
<td>139,660</td>
</tr>
<tr>
<td>Filled out end-of-course questions</td>
<td>0.65</td>
<td>(0.48)</td>
<td>139,660</td>
</tr>
</tbody>
</table>

NOTE: Sample includes all UTT undergraduate students between AY2012 and AY2017 who took at least one course in a subject area which offered PATSS courses. Grade points indicate the percentage of students who received such a grade in a course.
Table 2.4 summarizes the EOC questions that students were asked to answer at the end of each semester. The UTT Faculty Senate decides which questions should be included in these questionnaires, and this table contains all questions that were asked at least once during our study period. The variation in the number of observations reflects both the fact that students are not required to answer these questions and that the Faculty Senate often modifies the question list. The questions at the bottom of the table were designed by our study team specifically to aid in our assessment of the PATSS program. Overall, most courses and instructors received very high evaluation scores—the mean of each of the UTT questions was over 4.0 on a scale of one to five.

Table 2.4. Summary of the EOC Questions

<table>
<thead>
<tr>
<th>EOC Question</th>
<th>Mean (s.d.)</th>
<th>Min</th>
<th>Max</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard UTT questions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course was well organized</td>
<td>4.26 (0.98)</td>
<td>1</td>
<td>5</td>
<td>61,155</td>
</tr>
<tr>
<td>Tests and assignments were usually graded and returned promptly</td>
<td>4.31 (0.95)</td>
<td>1</td>
<td>5</td>
<td>60,958</td>
</tr>
<tr>
<td>Instructor made me feel free to ask questions, disagree, and express my ideas</td>
<td>4.33 (0.93)</td>
<td>1</td>
<td>5</td>
<td>61,063</td>
</tr>
<tr>
<td>Overall, this instructor was excellent</td>
<td>4.22 (1.00)</td>
<td>1</td>
<td>5</td>
<td>87,255</td>
</tr>
<tr>
<td>Overall, this course was excellent</td>
<td>4.09 (1.03)</td>
<td>1</td>
<td>5</td>
<td>69,855</td>
</tr>
<tr>
<td>Instructor was readily available to me</td>
<td>4.35 (0.91)</td>
<td>1</td>
<td>5</td>
<td>81,862</td>
</tr>
<tr>
<td>Instructor used a variety of effective teaching methods and activities that help</td>
<td>4.16 (1.05)</td>
<td>1</td>
<td>5</td>
<td>55,788</td>
</tr>
<tr>
<td>Instructor was very interested and enthusiastic about the subject matter</td>
<td>4.47 (0.83)</td>
<td>1</td>
<td>5</td>
<td>55,822</td>
</tr>
<tr>
<td>Instructor clearly defined and explained the course objectives and expectations</td>
<td>4.36 (0.94)</td>
<td>1</td>
<td>5</td>
<td>60,705</td>
</tr>
<tr>
<td>Instructor was prepared for each instructional activity</td>
<td>4.40 (0.91)</td>
<td>1</td>
<td>5</td>
<td>60,704</td>
</tr>
<tr>
<td>Instructor communicated information effectively</td>
<td>4.25 (1.04)</td>
<td>1</td>
<td>5</td>
<td>60,704</td>
</tr>
<tr>
<td>Instructor encouraged me to take an active role in my own learning</td>
<td>4.39 (0.89)</td>
<td>1</td>
<td>5</td>
<td>60,704</td>
</tr>
<tr>
<td>Instructor adhered to syllabus and was clear about any changes</td>
<td>4.40 (0.88)</td>
<td>1</td>
<td>5</td>
<td>34,546</td>
</tr>
<tr>
<td><strong>Questions designed for PATSS study</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knew format of course at registration</td>
<td>0.95 (0.21)</td>
<td>0</td>
<td>1</td>
<td>26,158</td>
</tr>
<tr>
<td>Hours each week spent studying for this class</td>
<td>2.37 (1.26)</td>
<td>0</td>
<td>4</td>
<td>26,157</td>
</tr>
<tr>
<td>Times each week met face-to-face with the instructor</td>
<td>1.31 (0.99)</td>
<td>0</td>
<td>4</td>
<td>26,157</td>
</tr>
<tr>
<td>Hours each week met face-to-face with the instructor</td>
<td>1.95 (1.30)</td>
<td>0</td>
<td>4</td>
<td>26,157</td>
</tr>
<tr>
<td>Offered modality was the most preferred</td>
<td>0.67 (0.47)</td>
<td>0</td>
<td>1</td>
<td>25,072</td>
</tr>
</tbody>
</table>

NOTES: Not all questions were asked in every quarter. Responses to questions were not mandatory. This list includes all EOC questions that were asked in at least one PATSS course. Times per week face-to-face, hours per week face-to-face, and study hours per week questions were truncated at 4. s.d. = standard deviation; min = minimum; max = maximum; obs = observations.
Methods

We were interested in understanding the causal impact of the hybrid modality on student learning compared with traditional face-to-face classroom instruction; however, we faced two main challenges in the empirical identification of this impact.

The first challenge was that we could never observe the true counterfactual of student learning outcomes under both PATSS and traditional course modalities. One solution to this problem would involve a randomized controlled trial, whereby students would be assigned at random to versions of the course that are taught through different modalities. The randomized assignment would imply that the observed learning outcomes under the two modalities are counterfactuals for one another, and thus the causal impact of PATSS versus face-to-face instruction would be identified by the difference in mean outcomes. Absent such an experiment, our empirical strategy in this project estimated the impact of PATSS over face-to-face courses by looking at the same faculty member who taught the same course over time as the course transitioned from one modality to the other. This technique is known as a fixed effect, or within estimator, as it looks at the correlation between students’ learning outcomes and the course modality within a given course taught by a particular faculty member. Under the untestable assumptions that faculty are not selectively choosing a course modality to match students’ ability and that faculty’s evaluation process is not affected by the course modality, this fixed effect model mimics a randomized controlled trial. We also control for time (semester) fixed effects and student fixed effects; student fixed effects are especially important because they control for the fact that students of different abilities may systematically take PATSS courses. We do not, however, observe any time-varying factors that may induce students to enroll in a particular course modality, and thus we cannot control for this type of systematic selection. Bias from this source of endogeneity should be minimized to the extent that students do know the modality of the section they enrolled, as was reported by many students (see Results).

The second challenge we face is that we have a very limited set of data that measures student learning; namely, we only observe grade points earned by students and EOC evaluation scores of the instructor. Grade points can take on integer values between zero and four (inclusive), and as shown in Table 2.3, the majority of students (74 percent) earned either three or four grade points. This limited variation in the outcome implies that it would be difficult to detect true changes in learning due to PATSS if those changes were not significant enough to result in a student receiving a different grade point. More-ideal measures of learning would be the underlying percentage points earned in a course or a summative, end-of-curriculum exam—for example, the Graduate Record Examinations (either the general exam or subject-specific exams). Likewise, EOC evaluation scores are subjectively self-reported by students, which raises questions about how well they reflect learning gains. Because students were not required to answer the EOC questions, there are doubts about whether the sample of students who did answer were representative of the student population.
Below, we present the main results of our regression analyses in graphical form. Appendix A contains a detailed description of the empirical regression model, as well as the full set of regression estimates.

**Results**

**Main Impact of PATSS on Course Grades**

Figure 2.1 presents the main results of the impact of PATSS on course grades in each of the years of study. The estimates on the left are from our fixed effect model, which compares grade points earned across course modalities within a course taught by a given professor. For the first three years of the program, there was no significant difference between PATSS and non-PATSS courses, while in AY2017 students received 0.08-higher grade points in PATSS courses, an estimate which is statistically distinguishable from zero. Even the most-significant estimate from AY2017 is small in magnitude, reflecting a change of 0.07 grade points (the standard deviation of the grade distribution is 1.1 points).

**Figure 2.1. The Impact of PATSS on Grade Points**

![Graph showing the impact of PATSS on grade points](image)

**p <0.05**

For the purpose of comparison, we also show the estimates on the right side of Figure 2.1, which represent the unconditional differences in average grade points earned by students in PATSS versus non-PATSS courses—i.e., those which would result from a naïve comparison of
PATSS and non-PATSS courses. The estimates for AY2014 and AY2015 are not significantly different from zero, while those for AY2016 and AY2017 are significantly less than zero.

We also created a model which pooled all of the academic years from 2014 to 2017, and we found that PATSS had a positive yet insignificant impact (0.03 grade points) on course grades. This pooled model increases the precision of the point estimate—i.e., reduces the standard error—but also reflects a weighted average of the four disparate coefficients presented in Figure 2.1.

Overall, the evidence from Figure 2.1 suggests that PATSS courses did not have a large impact on student grades, either positive or negative. Importantly, however, we can rule out the possibility that there were larger negative impacts on grades from the hybrid modality than from face-to-face instruction.

Impacts by College Experience and Course Level

The hybrid modality might be more or less effective among students with different amounts of college experience, so we estimated the impact of PATSS within each class (freshman, sophomore, junior, and senior, as defined by students’ cumulative credit hours). Figure 2.2 contains these estimates, pooled across all academic years (the same conclusions result disaggregating across years), yet there are no estimates significantly different from zero.

Figure 2.2. The Impact of PATSS by Academic Class and Course Level

** p < 0.05, * p < 0.1
Hybrid courses might also be more or less suited to different levels of academic difficulty, so we estimated the impact of PATSS by course level (100-, 200-, 300-, and 400-level courses). Figure 2.2 shows that students did equally well in PATSS when compared with the traditional modality in 100- and 200-level courses, but they do slightly better in PATSS versions of 300- and 400-level courses, by 0.07 and 0.06 grade points, respectively. The results are similar when looking at separate academic years.

Impact in Follow-On Courses

One criticism of using course grades to measure the impacts of PATSS is that faculty members could systematically tailor the grades they give to the course modality. Another criticism is that current grades do not capture long-run gains in learning. One way to address both of these concerns is to study the impact of the hybrid modality on a student’s performance in a follow-on course.

For this exercise, we compiled a list of all UTT courses which had a direct and natural follow-on course—for example, Calculus 1 into Calculus 2, or Introductory Microeconomics into Intermediate Microeconomics. We then restricted the sample to only these follow-on courses and regressed a student’s grade in the follow-on course on an indicator of whether the student took a PATSS version of the prerequisite. We could not include student fixed effects in such a model, so we instead controlled for the student’s cumulative grade-point average (GPA) and the grade received in the prerequisite course. As with our main specification, we include semester-year and faculty-by-course fixed effects.

Figure 2.3 contains the results of this regression for all students and by class and course level of the follow-on course. Overall, there is no significant impact of having taken a PATSS prerequisite on the grade received in the follow-on course (the point estimate is 0.016 grade points). There is also little evidence that this null effect varies across the student’s academic experiences or the difficulty of the course. The one significant estimate is for 300-level courses, with a point estimate of −0.226, signaling that PATSS students might not have been as prepared as students who took the traditional face-to-face prerequisite. However, note that this is an extremely small sample of 522 students, and the multiple comparisons we are making increase the likelihood of finding any significant estimates.
Impact of PATSS on EOC Evaluations

Table 2.3 showed that, across all students in all courses, only 65 percent of students filled out their EOC evaluations. In order to assess whether the decision to answer the questions was related to the course modality, we regressed an indicator of answering the questions on the PATSS course indicator in our faculty-by-course, student, and fixed effect model. The coefficient on PATSS is a robust zero, which helps alleviate the concern that our estimates of the impact of PATSS on student opinions are being driven by self-selection.

Appendix Table A.4 presents the impacts of PATSS on EOC survey questions. For all questions, students in PATSS sections scored the course less favorably, and most of these negative coefficients are significantly different from zero. For example, when answering whether the course was well organized, students in the PATSS version scored the course 0.168 points lower on a scale of one to five. Despite the significantly negative impacts, these estimates are relatively small in magnitude.

Most students (96 percent) knew the course modality upon registration. Perhaps not surprisingly, however, students in PATSS sections were 9.5 percentage points less likely to know the format of the course at the time of registration. Students in PATSS courses did not report spending different amounts of hours studying than those in face-to-face courses (an insignificant –0.013 hours), but on a per-week basis they met with the instructor for fewer hours (–0.55) and fewer times (–0.45) than intended by the program.

The final question we asked was about whether the students believed the offered modality was their most preferred, in order to directly capture student course modality preferences. While
overall 67 percent of students preferred the modality they had chosen, PATSS students were 14.9 percentage points more likely to prefer either a face-to-face or online version of the course, rather than the hybrid version they chose.

It is reasonable to believe that students have a preferred course modality, and so we next replicated the analyses presented in Appendix Table A.4 for the 95 percent of students who knew the course modality upon registration. Appendix Table A.5 contains these results: Students in PATSS sections have views of the instructor and course that are indistinguishable from those in face-to-face courses. The negative impressions of PATSS instructors and courses are driven by those students who were “surprised” to end up in a hybrid course. For one outcome—“Instructor encouraged me to take an active role in my own learning”—PATSS students gave a rating 0.08 points higher than that of traditional students. Interestingly, however, 11.2 percent of students in this sample would have preferred the course had been taught either traditionally or fully online, rather than in a hybrid modality.
3. Qualitative Data for Continuous Improvement

Overview of Qualitative Data and Approach to Continuous Improvement

In addition to providing rigorous estimates of the impact and costs of the PATSS program, our study also sought to identify areas in need of improvement that could be addressed as UTT continued to implement and refine the program. We implemented a formal continuous improvement process in which we gathered, analyzed, and shared data with UTT administrators and staff on a regular basis to help inform changes to policy and practice. To support these efforts, we engaged regularly with UTT administrators and staff and collected a range of qualitative data from students, faculty, and staff.

Table 3.1 shows the specific data we collected in each year of the project. At the end of each project year, we used the findings from these data and our quasi-experimental evaluation to develop a preliminary set of recommendations for improving the implementation of PATSS. During annual engagement sessions with UTT faculty and administration, we shared findings from our quantitative and qualitative analyses and gathered input to help us better contextualize the findings. During those engagement sessions, we also shared our preliminary recommendations for improving the implementation of PATSS and gathered input and suggestions for refining the recommendations. Members of the UTT administration then decided whether and how to act on the interim recommendations.

In the remainder of this chapter, we describe each of the qualitative data sources we used and the key findings we extracted from them. Since the qualitative data were collected primarily to facilitate our continuous improvement process, we do not describe the data collection process or results in detail. However, we do provide high-level findings that were used to develop our annual recommendations for improvement. Next, we describe the continuous improvement process and some of the concrete steps that UTT undertook to improve the PATSS program based on qualitative and quantitative findings. We provide protocols and other relevant materials in Appendix B.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Student focus groups</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student survey</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PATSS-related questions added to EOC survey</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Faculty focus groups</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Faculty survey</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Instructional designer focus group</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Year One Focus Groups and Surveys Provided a Lay of the Land

Our study began during the second year of implementation of PATSS. In order to understand the context and identify challenges with the initial phase of implementation, we collected a range of qualitative data during the 2014–2015 academic year, the first year of our study. These data included answers from a student survey, as well as comments collected in student and faculty focus groups. These data also helped inform the development of regular student and faculty surveys that we conducted in subsequent years of the study.

Year One Student Pilot Survey

In November 2014, we conducted a pilot survey to gauge the opinions and preferences of students who were taking a PATSS course during the fall 2014 semester. The anonymous survey was conducted online using Qualtrics software. We sent recruitment emails to all 1,170 students who were taking at least one PATSS course during the fall semester, and 250 students responded to the survey. The respondent characteristics largely mirrored those of the wider UTT student body; however, respondents were slightly more likely to be female. See Appendix B for the survey instrument.

Overall, respondents reported positive perceptions of and experiences with PATSS courses. Specifically, relative to face-to-face courses, respondents felt that PATSS courses were equally engaging and rigorous. Respondents also reported that PATSS courses allowed them to better organize their time, that they were adequately prepared for PATSS courses, and that they could easily access the online content. Respondents also strongly preferred hybrid and face-to-face course formats to online formats. Ordinary least squares regressions also suggested that older students and males preferred hybrid formats.

Year One Student Focus Groups

To complement our student pilot survey, gather richer information about student experiences in and perceptions of PATSS, and capture suggestions for improvement, we conducted a series of focus groups with students who had taken at least one PATSS course. We recruited students to participate in focus groups via the Fall 2014 Student Pilot Survey. That survey concluded with an option for interested students to provide their contact information to participate in a focus group during the spring 2015 term. We also sent emails and posted flyers around campus asking interested students who had taken a PATSS course to provide their contact information via an online link. Through this process, we recruited 20 students who participated in seven focus groups that were conducted from March to May 2015. The protocol for these focus groups is provided in Appendix B.

As with the Pilot Survey, students who participated in the focus groups generally expressed overall satisfaction with PATSS courses. Specifically, students reported that PATSS courses were “more flexible than face-to-face courses,” “enjoyable,” and “less stressful than face-to-face courses.” Students liked the mix of online lectures and in-class projects and practice and would
like more PATSS courses to be offered, particularly during the summer. Some students also reported that PATSS courses helped them to reduce their commute times.

While students reported positive experiences with PATSS courses on average, their experiences were highly dependent on elements of the course design. For example, students preferred recorded lectures to online textbooks and voiced-over PowerPoint slides, and preferred when those lectures were broken up into short recorded videos as opposed to a single long recorded lecture. Students also preferred when faculty incorporated multiple ways to engage regularly with students with office hours, online discussion forums, and timely responses to email and other electronic communication. Some students expressed confusion about expectations for online versus in-class components of PATSS courses, while others reported having difficulty learning technical course material via the online component.

Some students also reported challenges with scheduling and technology. In particular, some students noted that in-person PATSS meeting times are not always aligned with the days other courses are usually offered face-to-face, which would be necessary to reduce commuting needs. Some students also noted that they were unable to discern course formats from the course catalog during registration, and hence were surprised when they learned that they were taking a PATSS course. Some students experienced disruptions in access to online content and difficulty with sound in recorded lectures. Finally, some students reported wide variance in faculty member comfort with and ability to effectively use technology, which impacted the students’ experiences in and perceptions of PATSS.

Year One Faculty Focus Groups

We also conducted a series of focus groups with faculty who had taught a PATSS course, in order to gauge their experiences with and perceptions of PATSS and identify their suggestions for improving the program. We sent recruitment emails to all faculty members who had taught a PATSS course during fall 2014 to participate in a focus group during spring 2015. Eight faculty members participated in five focus groups from April to May 2015. See Appendix B for the protocol.

In general, most faculty members surveyed reported that they felt that PATSS had improved their course. Most faculty members reported that, on average, students did as well or better in a PATSS course, compared with their performance in a traditional face-to-face course; but some faculty members reported that there was wider variance in student performance than in traditional face-to-face formats. Faculty reported that online lectures freed up classroom time for enrichment activities: group learning activities, question and answer sessions, or field trips. Faculty members also reported liking the fact that the online component of PATSS courses offered many ways to engage with students, for example, through regular chat sessions and message boards. Crucially, faculty members reported that the instructional designers and PATSS training sessions were integral to the program’s success. Some also reported that they had incorporated what they had learned through PATSS training into some of their other classes.
Faculty members also reported that PATSS courses altered their time usage. In particular, they suggested that there is a large upfront cost to design a PATSS course and prepare online content, which is substantially offset by the support of instructional designers. After incurring the fixed upfront cost, faculty members reported spending relatively less time teaching PATSS courses. However, some faculty members reported that the decreased time commitment was offset by an increased number of students per section, and an associated increase in time devoted to grading and engaging with a larger number of students. Some faculty members suggested this increased time for grading and student engagement could be offset by graders or course assistants. There was also wide variance in the amount of time faculty members needed to spend updating course content over time that varied by course. For example, math or physics courses often required few updates, while courses that focused on current events needed regular updates.

Faculty members also noted a number of challenges with PATSS courses. For example, many faculty members noted difficulty accessing resources like instructional designers and green rooms at peak times and at satellite campuses. Others noted difficulty in deciding what to do in the classroom, since lectures were delivered online; still others noted difficulty with revising and incorporating new content into courses. Some faculty members also noted difficulty teaching complex or technical content online, while others had challenges using the necessary technology.

Annual Surveys Provided Systematic Information We Could Monitor over Time

We used the information we gleaned from the student pilot survey and student and faculty focus groups to develop survey instruments that we could administer annually, in order to continue to gauge the progress of implementation and identify additional problems to address. Specifically, we conducted an annual survey of PATSS faculty, and we added five PATSS-related questions to UTT’s regular EOC survey for all courses at the institution.

Annual Faculty Surveys

We conducted an annual faculty survey each spring from 2016 to 2018. The anonymous survey was conducted online using Qualtrics. During March of each year, we sent recruitment emails to all UTT faculty members who had ever taught a PATSS course. Each year, we left the survey in the field for three weeks, and we sent up to three reminder emails to increase response rates. Table 3.2 shows the number of PATSS faculty members that we sent recruitment emails to and the number who responded to those emails each semester. During the three years that we conducted the faculty survey, we achieved an average response rate of 44 percent. See Appendix B for the survey instrument.
The surveys showed a mixed picture of faculty perceptions of PATSS course quality and student experiences. Overall, the majority of PATSS faculty felt PATSS classes were of high quality and provided learning opportunities for students that were as good as or better than traditional courses. However, faculty members reported that they felt that students preferred traditional face-to-face classes over PATSS courses. The faculty was also divided about whether they would like to teach additional courses in the PATSS format.

Faculty members also reported that the PATSS training and professional development opportunities benefited their teaching in PATSS and other courses and offered suggestions for improvement. Across survey years, over 85 percent of respondents reported that the PATSS training met or exceeded their expectations, and over 80 percent of respondents reported that the PATSS program at least slightly improved their teaching. In free-response items, a number of faculty members reported wanting more ways to collaborate with other PATSS faculty during the academic year outside of the regular training sessions. Some faculty members also noted that new PATSS faculty often have different training needs compared with previously trained faculty, particularly related to technology use, and suggested that providing separate or supplemental training sessions for faculty with those needs might be more efficient.

Questions related to time use suggested that, relative to traditional face-to-face courses, PATSS courses require slightly more faculty time to teach effectively. Faculty members reported spending approximately 59 hours to flip a course to PATSS, 25 of which were spent working directly with an instructional designer. This time would not be incurred if the faculty member did not flip the course to PATSS and simply continued teaching the course in a face-to-face format. Faculty members also reported spending roughly equal amounts of time, ten hours per week, teaching PATSS and face-to-face courses. Finally, faculty members reported spending slightly more time, 32 hours, updating course content for PATSS courses relative to the 25 hours spent updating course content for face-to-face courses.

PATSS faculty also reported that teaching a PATSS course reduced their number of weekly commutes to campus by 1.35 on average, because they often needed to drive to campus for reasons like teaching other courses, holding office hours, attending meetings, or conducting research.

Finally, faculty members identified a number of areas where the efficiency of the PATSS program could be improved. For example, faculty also reported that classroom space was often allocated to them during the days when their PATSS course was not meeting face-to-face. This
might be due to difficulty in coordinating classroom assignments with course schedules that were set by faculty members.

Questions Added to Student EOC Surveys

To capture systematic information from students regarding their experiences in and preferences for PATSS courses and other courses at UTT, we worked with the university to develop five questions that were added to the institution’s regular EOC surveys, which are conducted at the completion of each course. Leveraging the existing student EOC survey helped us to minimize burden on students and staff and achieve high response rates without the need to use additional participation incentives, such as cash payments. While participating in the EOC survey is voluntary for students, it is widely known that it is an opportunity to provide important feedback on faculty members. Students also have an opportunity to fill out the survey during class time and receive early access to their grades if they participate. Thus, the survey has a response rate of over 60 percent, which is quite high for surveys of college students.

We added one question to the surveys to assess student preferences over all course formats among all students at UTT. Since our student and faculty focus groups had indicated that students did not always know the course format at the time of registration, leading to surprises when they learned they were in a PATSS course on the first day of class, we also added a question to assess student knowledge of course format at the time of registration.

We also added three items to assess faculty time and facility use in PATSS versus other modalities in order to address whether course format is accurately captured in administrative data sources: We assessed the extent to which faculty incorporate technology into face-to-face classes, the extent of technology usage by PATSS faculty in other classes, whether student grades and satisfaction relate to technology usage, and opportunities for improving classroom utilization. We then utilized these data in our cost study. See Appendix B for specific questions.

The results corroborated evidence from student and faculty focus groups that students in PATSS courses were often unaware of the course format at the time of registration, and students who were aware of the course format reported higher levels of satisfaction with the course. Overall, students had a slight preference for the hybrid and face-to-face modalities over courses that are delivered strictly online. Finally, regression analyses of the relationship between course modality and commuting patterns suggest that for every three PATSS courses a student takes, as opposed to face-to-face, there is an associated decrease of one weekly commute to campus. We use this result in the cost study and describe the analysis in Chapter 4.

Additional Qualitative Data Helped Fill in Gaps

We also collected additional qualitative data at various points during the study to include additional perspectives and gauge progress. In particular, we conducted a focus group with three instructional designers during spring 2017, and we fielded the student survey we had conducted in the first year a second time.
Year Three Instructional Designer Focus Group

Throughout our study, we heard from various stakeholders that instructional designers were an integral part of the implementation of PATSS. Faculty members noted that it was crucial to work collaboratively with an instructional designer to flip their traditional face-to-face course to the hybrid modality in a way that effectively leveraged the available technology. Faculty members had also consulted with instructional designers to troubleshoot issues with technology and communication while delivering their courses and to update course content over time. Administrators also noted the crucial role of instructional designers. One area of concern raised by both faculty members and administrators was the perception that instructional designers were always in high demand during the peak periods just before the start of the semester, when faculty members were finalizing their courses and lesson plans for the upcoming semester. Faculty members noted that it was often difficult to schedule sufficient time to work with instructional designers during these periods, while administrators argued that faculty members should shift their timeline for developing and refining their courses to other times during the academic year so that instructional designers would be more accessible.

Given the perceptions of instructional designers among UTT stakeholders, we decided to conduct a focus group with three then-current instructional designers in spring 2017 to gather their thoughts on PATSS and their suggestions for improvement. We were also interested in the relationship between instructional designers and PATSS faculty and in suggestions for improving the relationship and smoothing out the demand for their services.

The focus group confirmed the perceptions among faculty members and administrators that instructional designers struggled to meet demand for their time during peak hours before the start of each semester. Instructional designers noted that, ahead of the semester beginning, they had worked to identify faculty members who were interested in collaborating with them to flip a course to PATSS or to integrate more technology into a traditional face-to-face course and had worked to set clear milestones and deadlines that could be met well before the start of the semester. However, they reported that faculty members rarely met their deadlines and that work typically ended up falling back to the peak period just before the start of the semester.

Instructional designers also reported that they felt like faculty misunderstood the role the designers held. For example, while instructional designers reported that they were hired to work collaboratively with faculty members to better integrate technology into their classes and to transition course from one format to another, the designers felt like faculty members wanted them to “do everything” and take a syllabus and course materials from a face-to-face course and flip it to PATSS. Instructional designers also reported that some faculty members saw them as “technicians” and used them to “put out fires” with technology during class time.

Year Four Student Survey

In order to gauge progress toward improving the opinions and preferences of students taking PATSS courses over the course of our study, we fielded the first-year student survey a second time in spring 2018. The anonymous survey was conducted online using Qualtrics. We sent
recruitment emails to all enrolled students (11,255 students) during the fall semester, and 620 students responded to the survey.

The student survey results from spring 2018 largely mirrored the results from fall 2014, and there were no major statistically significant differences in responses over time. In particular, the spring 2018 student survey showed that respondents reported having largely positive perceptions of and experiences with PATSS courses. Specifically, relative to face-to-face courses, respondents felt that PATSS courses were equally engaging and rigorous. Respondents also generally reported that PATSS courses allowed them to better organize their time, that they were adequately prepared for PATSS courses, and that they could easily access the online content. As with the first-year survey, respondents also strongly preferred hybrid and face-to-face course modalities to the online-only modality. Ordinary least squares regressions also suggested that older students and males preferred hybrid modalities more than other students.

Continuous Improvement Process

We used the qualitative and quantitative data we collected to support a continuous improvement process for PATSS. The research team worked directly with Scott Marzilli, who was the associate vice provost for academic innovation and student success at UTT until the winter of 2018, and oversaw the implementation of PATSS. The research team held monthly calls with Marzilli to share findings and consider implications for PATSS. Marzilli also helped the research team to contextualize findings and prioritize topics for further exploration.

At the end of each year of our study, we distilled findings and developed a set of concrete and actionable recommendations to improve the implementation of PATSS in the next academic year. In annual faculty and administration engagement sessions, we shared findings and recommendations, asked for input on our study and our interim recommendations, and gathered additional suggestions for improvement. We conducted the first annual engagement session in October 2015 and conducted additional engagement sessions during annual PATSS training sessions in May 2016 and May 2017.

Reactions to Study Findings and Recommendations

Faculty and administrators were generally supportive of the study and felt that the findings were largely consistent with their experience and expectations. However, faculty members voiced a number of concerns at various times. For example, since we did not gain access to UTT administrative data until September 2015, we did not have time to produce quantitative results for the first engagement session. Therefore, during the first faculty engagement session, a number of faculty members and administrators voiced concerns over the limited number of students and faculty members that we had been able to include in the focus groups during the first year and suggested that we wait for more comprehensive data to make substantive changes to the program. In response, we accelerated the pace of the quantitative component of our study
and the implementation of student and faculty surveys that we conducted in subsequent project years.

During the first faculty engagement session, some faculty members voiced concerns over our plan to add questions to the student EOC surveys, particularly since these surveys are used in faculty performance evaluations. To address these concerns, we worked with the UTT Faculty Senate and administration to develop a process to ensure the additional data items would only be available to the research team and not connected to individual faculty members.

**Concrete Actions Taken by UTT to Improve the Implementation of PATSS**

Throughout the study, the team raised a number of findings for UTT to consider. UTT took actions to address many of these findings. For example, as a result of the information from student and faculty focus groups and the first-year student survey that showed that students often did not know the format of the course when they registered for it, and preferred the course format when they knew what it would be upon registration, UTT developed a process to ensure that accurate information on course format would be included in the course schedule at the time of registration and added a tag to UTT course codes that would identify PATSS courses.

Faced with evidence from student focus groups that students did not like online course material delivered as voiced-over PowerPoint slides and preferred professionally produced video lectures broken into digestible pieces, UTT directed its instructional designers to work with faculty to shift toward the more interactive format.

Finally, based on feedback from faculty focus groups and surveys that showed that the faculty wanted more technical training on how to use particular technology and develop pedagogy, and that they wanted introductory material to be optional for faculty members who had experience with PATSS, UTT adapted its training and professional development opportunities accordingly.
4. Estimation of the Costs and Benefits of PATSS to Students, Faculty, and Institution

Approach

An important component of our evaluation of PATSS is an accounting of the program’s costs. These costs must be measured in economic terms, which include both accounting costs (the outlay of dollars for goods and services) and opportunity costs (e.g., time saved by faculty). However, we recognize the importance of budgetary outlays for decisionmakers, and so we document the incidence of types of cost in our analysis below and in Table 4.1.

The following two courses of action (COAs) guide our analysis:

- COA 1: The PATSS program exists in its current form.
- COA 2: The PATSS program does not exist at UTT, and all courses are taught as traditional face-to-face courses.

In light of the many similarities in costs and benefits across these COAs, our analysis does not calculate total costs and benefits, but rather differential costs. A calculation of total costs and benefits would not necessarily be useful, as many elements are the same between non-PATSS (i.e., face-to-face or fully online) courses and PATSS courses; for example, faculty salary per course taught.

All costs and benefits must accrue to stakeholders. The stakeholders in this analysis include UTT students, UTT faculty, UTT administration, and society as a whole, which includes the local community and Texas more broadly.

In this section, we categorize impacts on stakeholders and explain the methodology for estimating the monetary value of these impacts. Most impacts are quantifiable and monetizable under reasonable and justifiable assumptions. However, hard-to-monetize impacts are equally important, and any policy decisions must recognize the potential size of these non-monetized impacts.
Table 4.1. Impact Categories of PATSS and Associated Differential Monetary Costs of PATSS Versus Traditional Face-to-Face Courses

<table>
<thead>
<tr>
<th>Impact</th>
<th>Data</th>
<th>AY2014</th>
<th>Per Person-Semester</th>
<th>Total</th>
<th>AY2015</th>
<th>Per Person-Semester</th>
<th>Total</th>
<th>AY2016</th>
<th>Per Person-Semester</th>
<th>Total</th>
<th>AY2017</th>
<th>Per Person-Semester</th>
<th>Total</th>
<th>Average, AY2014–2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stakeholder: students</strong></td>
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<tr>
<td><strong>Impact category: school or life outcomes</strong></td>
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<tr>
<td>Wages after college</td>
<td>Not available</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
<tr>
<td>Quality of education</td>
<td>Hard to monetize</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Time to degree</td>
<td>Not available</td>
<td>–</td>
<td>–</td>
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</tr>
<tr>
<td>Total monetizable cost for students</td>
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<td>$-346,378</td>
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<td>$-615,813</td>
<td>$-266</td>
<td>$-395,427</td>
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<td>$-351,163</td>
<td>$-191</td>
<td>$-427,195</td>
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<tr>
<td><strong>Stakeholder: faculty</strong></td>
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</tr>
<tr>
<td><strong>Vehicle usage for commuting</strong></td>
<td>Faculty survey</td>
<td>−$9,452</td>
<td>−$220</td>
<td>−$18,903</td>
<td>−$220</td>
<td>−$15,482</td>
<td>−$206</td>
<td>−$37,381</td>
<td>−$512</td>
<td>−$20,304</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact category: teaching, preparation, and training time</td>
<td></td>
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</tr>
<tr>
<td><strong>Time for PATSS training and initial course preparation</strong></td>
<td>Faculty survey</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td></td>
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</tr>
<tr>
<td><strong>Time to teach, advise, and grade course</strong></td>
<td>Faculty survey</td>
<td>$8,946</td>
<td>$208</td>
<td>$17,892</td>
<td>$208</td>
<td>$15,603</td>
<td>$208</td>
<td>$34,600</td>
<td>$474</td>
<td>$19,260</td>
<td></td>
<td></td>
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<tr>
<td>Impact category: preferences</td>
<td></td>
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</tr>
<tr>
<td><strong>Willingness to pay for course modality</strong></td>
<td>Hard to monetize</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>−</td>
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<td></td>
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</tr>
<tr>
<td><strong>Total monetizable cost for faculty</strong></td>
<td></td>
<td>−$10,862</td>
<td>−$253</td>
<td>−$21,724</td>
<td>−$253</td>
<td>−$17,942</td>
<td>−$239</td>
<td>−$38,300</td>
<td>−$525</td>
<td>−$22,207</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Impact category: Training</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Stipends—training</strong></td>
<td>PATSS admin</td>
<td>$36,000</td>
<td>−</td>
<td>$78,500</td>
<td>−</td>
<td>$52,000</td>
<td>−</td>
<td>$54,000</td>
<td>−</td>
<td>$55,125</td>
<td></td>
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</tr>
</tbody>
</table>
### Differential Costs of PATSS (COA 1) Versus Face-to-Face Courses (COA 2)

<table>
<thead>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Per Person-Semester</td>
<td>Total</td>
<td>Per Person-Semester</td>
<td>Total</td>
<td>Per Person-Semester</td>
</tr>
<tr>
<td>Stipends—development</td>
<td>PATSS administration</td>
<td>$58,000</td>
<td>–</td>
<td>$114,000</td>
<td>–</td>
<td>$66,000</td>
</tr>
<tr>
<td>Stipends—assessment</td>
<td>PATSS administration</td>
<td>$48,000</td>
<td>–</td>
<td>$24,000</td>
<td>–</td>
<td>$2,000</td>
</tr>
<tr>
<td>Faculty development</td>
<td>PATSS administration</td>
<td>$0</td>
<td>–</td>
<td>$32,414</td>
<td>–</td>
<td>$6,819</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>Impact category: Operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td>PATSS administration</td>
<td>$0</td>
<td>–</td>
<td>$8,076</td>
<td>–</td>
<td>$3,883</td>
</tr>
<tr>
<td>Management and operation</td>
<td>PATSS administration</td>
<td>$0</td>
<td>–</td>
<td>$4,570</td>
<td>–</td>
<td>$3,276</td>
</tr>
<tr>
<td>Travel</td>
<td>PATSS administration</td>
<td>$0</td>
<td>–</td>
<td>$0</td>
<td>–</td>
<td>$691</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>Impact category: Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefits/fringe</td>
<td>PATSS administration</td>
<td>$0</td>
<td>–</td>
<td>$0</td>
<td>–</td>
<td>$0</td>
</tr>
<tr>
<td>Student wages</td>
<td>PATSS administration</td>
<td>$0</td>
<td>–</td>
<td>$0</td>
<td>–</td>
<td>$1,836</td>
</tr>
<tr>
<td>Admin support</td>
<td>PATSS administration</td>
<td>$16,000</td>
<td>–</td>
<td>$17,500</td>
<td>–</td>
<td>$17,500</td>
</tr>
<tr>
<td>Special projects</td>
<td>PATSS administration</td>
<td>$15,000</td>
<td>–</td>
<td>$15,000</td>
<td>–</td>
<td>$0</td>
</tr>
<tr>
<td>Administration</td>
<td>UT administration</td>
<td>$18,600</td>
<td>–</td>
<td>$18,600</td>
<td>–</td>
<td>$18,600</td>
</tr>
<tr>
<td>Instructional designers</td>
<td>UT administration</td>
<td>$29,140</td>
<td>–</td>
<td>$29,140</td>
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<td>$29,140</td>
</tr>
</tbody>
</table>
## Differential Costs of PATSS (COA 1) Versus Face-to-Face Courses (COA 2)

<table>
<thead>
<tr>
<th>Impact Category: Other</th>
<th>Average, AY2014–2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AY2014</td>
</tr>
<tr>
<td>Impact</td>
<td>Data</td>
</tr>
<tr>
<td>Program evaluation</td>
<td>PATSS administration</td>
</tr>
<tr>
<td>Operating costs: lights, HVAC, cleaning, etc.</td>
<td>UT administration</td>
</tr>
<tr>
<td>Infrastructure: IT, computers, parking, buildings</td>
<td>Hard to monetize</td>
</tr>
<tr>
<td>Institutional quality: impact on future student demand, faculty quality, and school prestige</td>
<td>Not available</td>
</tr>
<tr>
<td>Total monetizable cost for UTT</td>
<td>$217,610</td>
</tr>
</tbody>
</table>

### Stakeholder: Society

<table>
<thead>
<tr>
<th>Externalities from commuting</th>
<th>Hard to monetize</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>−</td>
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</table>

<table>
<thead>
<tr>
<th>Externalities from learning outcomes</th>
<th>Hard to monetize</th>
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<tr>
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</table>
## Differential Costs of PATSS (COA 1) Versus Face-to-Face Courses (COA 2)

<table>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Per Person-Semester</td>
<td>Total</td>
<td>Per Person-Semester</td>
<td>Total</td>
<td>Per Person-Semester</td>
</tr>
<tr>
<td>State subsidies for higher education</td>
<td>Hard to monetize</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Total monetizable cost for all stakeholders</td>
<td></td>
<td>–$139,631</td>
<td>–</td>
<td>–$195,748</td>
<td>–</td>
<td>–$110,835</td>
</tr>
<tr>
<td>Total cost with no program evaluation costs</td>
<td></td>
<td>–$139,631</td>
<td>–</td>
<td>–$301,998</td>
<td>–</td>
<td>–$217,085</td>
</tr>
<tr>
<td>Total cost with no program evaluation costs, per student</td>
<td></td>
<td>–$107</td>
<td>–</td>
<td>–$85</td>
<td>–</td>
<td>–$54</td>
</tr>
</tbody>
</table>

**NOTES:** UT = University of Texas; HVAC = heating, ventilation, and air conditioning; IT = information technology. Faculty were paid via stipends for their participation in the PATSS training; using the implied hourly rate of average faculty salaries and the number of hours spent in the training, the stipends approximately cover the time cost of training and course prep and conversion. Survey results imply that a future update to a PATSS course will take 7.4 more hours than an update to the same face-to-face course; we do not include this cost, as it is not clear how many times, and when, a future faculty member will have to update the course.
Impacts Borne by Students

UTT students are impacted by hybrid modality courses in many ways, but only the costs associated with reductions in commutes to campus are currently quantifiable and monetizable. We will discuss commuting costs after noting the intangible and hard-to-measure impacts.

Intangible and Hard-to-Measure Impacts

The abbreviation PATSS stands for Patriots Accessing Technology for Success and Savings. Aside from the benefits of reduced costs, the “success” of college students manifests itself in several impact categories: wages after college, degree completion, amount of time needed to achieve degree, time spent on coursework, and preferences—for example, willingness to pay for a particular course modality.

The differential impacts of PATSS on course-related outcomes—for example, grades—are reflected in our quantitative analysis of the impact. However, it is beyond the scope of our study to monetize these impacts. For example, students’ preferences are appropriately measured through the concept of willingness to pay for a PATSS course—this could encompass all of the aspects of a PATSS course that students value or dislike, including flexibility of when to work on the course, interaction or lack of interaction with peers. Attempting to map the effect of taking one or more PATSS courses into future wages would, at a minimum, require long-term data on PATSS graduates—data that do not yet exist.

Impacts Related to Commuting

Because the majority of UTT students commute to campus, any reductions in the number of commutes due to hybrid classes can have substantial impacts on students. Aside from preferences for course modality (which we discuss below), there are two main impacts of PATSS related to commuting: the opportunity cost of students’ commuting time and the monetary outlay of commuting expenses.

In order to estimate these impacts, we administered two anonymous online surveys to UTT students eliciting responses about their commuting behavior in the spring semesters of 2015 and 2017. A link to the first survey was included in students’ EOC evaluations; thus, the sample frame is all UTT students. The second survey was also sent by email to all enrolled students. After excluding students who live on campus (as they do not commute) and those who only take online courses, we had 120 responses from the 2015 survey and 79 from the 2017 survey. For most cost estimates, we applied the 2015 survey data to AY2014 and the AY2017 survey data to AY2016.

The ideal hypothetical question would have been, “How many fewer times per week did you commute because your PATSS course did not require you to be in the classroom as much as a face-to-face course?” We believed this question would be difficult to answer accurately, so instead we collected data that allow us to estimate the differential commuting trips associated with hybrid courses. Specifically, we asked students for their commuting time, the number of
commutes per week, and the number of online, hybrid, and traditional face-to-face courses they took.

In both surveys, students commuted to campus between three and four times per week, over 90 percent of students commuted to campus by car (the remainder either walked or biked), the average one-way commuting time was around 30 minutes, and for those who commuted by car the average one-way commute was around 25 miles.

As with the question on reduced commuting time due to PATSS, we would ideally have been able to elicit students’ willingness to pay to not have to commute to campus, as this reflects the theoretically correct value of the reduced commuting time associated with taking a hybrid course. However, eliciting willingness to pay is difficult (see Diamond and Hausman, 1994), and so we instead used a student’s wage as an approximation of the opportunity cost of time. Using the wage as the opportunity cost embodies the assumption that students could have been working instead of commuting, and we recognize that this is likely an upper bound on the opportunity cost of time; a reasonable lower bound is an opportunity cost of $0—it is unlikely that students would be willing to pay to commute. In our 2015 survey, we collected information on annual earnings and the number of hours worked per week, from which we could estimate that the average hourly wage rate among students who took any hybrid courses was $22.18 per hour. However, in the 2017 survey, we asked students directly what their wage was if they were working, and what wage they think they could earn if they decided to work; the average reported wage was $12.89 per hour. It seems reasonable that the hourly wage estimate from 2015 is an overestimate stemming from the nature of the way we collected the data, and so we prefer to use the $12.89 per hour wage for all years (as a comparison, the minimum wage in Texas during this time period was $7.25 per hour).

We next fitted regression models to estimate the differential commuting behavior of students who took different mixes of hybrid and face-to-face courses. The details of these regression models are in Appendix C. We find that among all commuters, one extra hybrid course is associated, on average, with a reduction of approximately one-third of a commute per week per student. Thus, the differential opportunity cost of time for a student taking a PATSS course in one semester is found by multiplying the reduced number of commutes per week ($\approx 0.33$) by the number of weeks per semester (14) by the hours traveled per round trip (around one hour) by the wage rate ($\approx$ $13 per hour). As seen in Table 4.1, we estimated the per-student semester cost savings of one additional PATSS course, instead of a traditional face-to-face course, as $66 in AY2014 and AY2015 and $54 in AY2016 and AY2017. The details of these calculations are in Appendix C. The number of students who took PATSS courses varied by year but ranged between 1,300 and 2,300. Multiplying the per-student figures by the number of students who took PATSS courses yielded the total time-cost savings ranging from $86,341 in AY2014 to $153,502 in AY2015.

Travel costs for car commuters were gas, insurance, and vehicle depreciation. Given the difficulty in capturing these for individual students, we instead use the Internal Revenue Service (IRS) vehicle operating costs. These costs vary by year, but are approximately $0.55 per mile.
The IRS costs are calculated to reflect the average costs across the U.S. population; because gas is generally cheaper in Texas than in the rest of the country, this operating cost is likely an upper bound on actual driving costs. We assume the 11 percent of students who walk or bike to school do not incur travel costs (or that those costs are very small).

For car commuters, we estimate that one extra hybrid course is associated with an average reduction of about 0.45 commutes per week per student (see Appendix A). Thus, the differential car-operating cost for a student taking a PATSS course in one semester is estimated as the number of reduced commutes per week \( \approx 0.45 \) times the number of weeks per semester \( \approx 14 \) times the number of miles per round-trip commute \( \approx 50 \) times the IRS cost per mile \( \approx \$0.55 \) per mile. Table 4.1 shows that vehicle cost savings per student semester ranged from \$200 in AY2014 to \$127 in AY2017. Multiplying by the number of students who took PATSS courses, we find cost savings that range from \$260,037 in AY2014 to \$462,311 in AY2015.

Note that while a small percentage of students took more than one PATSS course in a given semester, we did not ask students about commuting patterns if they took more than one PATSS course. In order to produce a conservative estimate of time savings, we assume that the additional commutes saved (and thus time and costs) are zero. If future schedules contain a more significant fraction of hybrid classes, this assumption should be reconsidered, and commuting data should be collected on the full array of course-type mixes.

**Impacts Borne by Faculty Members**

Faculty members are impacted in several ways by the PATSS program. As with students, faculty commuting patterns are influenced by the reduction in travel time associated with teaching PATSS courses. Faculty members are also impacted by the time it takes to be trained to teach in a hybrid modality, the additional preparation time for a hybrid course over a face-to-face course, and the time saved when teaching a hybrid course. Finally, faculty members may have differential preferences for course modality, but, as with students, these preferences are hard to quantify and monetize.

Data on faculty members came from two rounds of a survey on commuting, time use, and preferences associated with a hybrid modality. Both surveys were administered online via an email link that was sent out to all faculty who had ever taught a PATSS course. The surveys were conducted in the spring semesters of 2016 and 2017, with 24 and 30 faculty members responding, respectively. With no data for AY2014 and AY2015, we extrapolate the 2016 data back to those years.

**Intangible and Hard-to-Measure Impacts**

As with students, faculty members might have preferences for teaching either traditional face-to-face or hybrid modalities, and these could be monetized by eliciting willingness to pay

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for the preferred modality or willingness to accept to teach the modality that was not preferred. Faculty preferences are important because dissatisfaction with one’s job can precipitate turnover, which can be very costly in the specialized fields within higher education, which tend to have thin labor markets.

**Impacts Related to Commuting**

We estimate faculty commuting costs to be analogous to student commuting costs. The main difference from the student surveys is that we asked faculty members directly, “How many less [sic] times per week did you have to commute to campus because this was a hybrid rather than a face-to-face course?” which removed the need for the regression analysis we used with students.\(^5\)

In both surveys, the average one-way commute for a faculty member was around 25 miles and took about 30 minutes, the average wage was about $30 per hour, and faculty members reported commuting to campus about 1.5 fewer times per week due to teaching one PATSS course. Using the same methodology as for students, we find that the per–faculty-semester opportunity cost of teaching one PATSS course was $241 in AY2016 and $487 in AY2017. Multiplying by the number of PATSS faculty members, we find cost savings ranging from $10,356 in AY2014 to $35,518 in AY2017.\(^6\) Per–faculty-semester vehicle usage cost savings were $220 in AY2016 and $512 in AY2017, which implies total savings for all PATSS faculty members ranging from $9,452 in AY2014 to $37,381 in AY2017.

**Impacts on Faculty’s Time to Teach, Prepare, and Train**

When teaching students, faculty spend time in several ways, and we considered how time spent varied between PATSS and face-to-face courses. First, we consider the fixed costs of receiving PATSS training and the initial preparation of the course to be taught in a hybrid modality. Second, we consider the variable costs of teaching, advising, and grading, which are incurred each semester in which a course is taught.

PATSS training took a total of six hours and was completed by each faculty member in the summer prior to their first semester teaching a hybrid PATSS course. On top of this training, faculty members spent a considerable amount of time converting each course from traditional face-to-face modality to hybrid modality. Survey results from 2016 show that the average conversion time was 61 hours and was devoted to in-depth meetings with instructional designers, creating videos and online content, and thinking through the best way to deliver online content.\(^7\)

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\(^5\) We believed students would have trouble answering the hypothetical counterfactual question about how a hybrid course impacted commuting relative to a face-to-face course; in hindsight, it seems likely that they would have been able to answer such a question accurately.

\(^6\) This estimate is an upper bound. The savings per course would be lower if faculty taught multiple PATSS courses and commuted on a common day to campus to teach the face-to-face class. However, few faculty taught multiple PATSS courses in a semester.

\(^7\) Faculty may or may not have taught a course in a traditional face-to-face modality prior to teaching it as a hybrid PATSS course. In our faculty survey, we found that all PATSS faculty had previously taught the hybrid version of the course in a face-to-face modality. Even if faculty had not previously taught a course face-to-face, conversion
These 67 hours spent in training sessions and converting the course are a cost of the PATSS program, but PATSS faculty were compensated for these activities with stipends of $2,000. Because we include these stipend costs as outlays of the program, we do not include the time cost of these activities, as that would amount to double-counting.  

Teaching students in a semester course requires time input on several dimensions, including in-class teaching, advising, and grading. PATSS could increase or decrease the time required in any or all of these dimensions. For example, a hybrid modality course could reduce classroom time by replacing lectures with pre-recorded videos but increase the time spent advising students by email or in online discussions. Rather than collecting data on the uses of time, we simply asked how much the differential was in terms of aggregate time spent between PATSS and face-to-face modalities. On average, compared with the traditional face-to-face modality, faculty reported spending half an hour more per week teaching PATSS in AY2016 and 1.1 hours more per week in AY2017. Multiplying these figures by 14 weeks per semester and the average faculty wage of $30 per hour, this amounted to $208 per faculty semester course in AY2016 and $474 in AY2017. Multiplying by the number of PATSS courses taught per year, which ranged from 43 in AY2014 to 86 in AY2015, gives a total cost that ranged from $8,946 in AY2014 to $34,600 in AY2017.

Impacts Borne by UTT

The majority of the impacts borne by UTT were either direct budgetary outlays or easily monetizable, including training of PATSS faculty, operation of and staff for the PATSS program, the evaluation of the program, and operating costs in classrooms. Two additional categories are more difficult to measure: the impact of a transition to hybrid modality on capital infrastructure on the UTT campus and the impacts of PATSS on overall institutional quality, future student demand, and general school prestige.

The budgetary expenditures are relatively easy to measure. The first set of expenses were incurred directly by the PATSS program and include faculty stipends and development. As seen in Table 4.1, these varied across years and averaged between $100,000 and $200,000 per year. The next set of expenses were small amounts for operations, which includes marketing, management, operations, and travel, never exceeding the $12,500 spent in AY2015. Staff included the program administrator, administrative support, student workers, special projects support, and instructional designers. The program administrator devoted 10 percent effort to PATSS, which translates into $18,600 per year, considering a yearly salary of $150,000 and a

\[ 60 \text{ hours} \times \$30/\text{hour} = \$1,800 \]

It is worth noting that if faculty are not compensated for converting a class to hybrid modality in the future, the economic cost of conversion will equal the opportunity cost of the faculty member’s time. Using our estimate of the conversion time and the average faculty wage rate as an approximation of the cost of time, the cost of conversion for a single course would be approximately $1,800 (\(= 60 \text{ hours} \times \$30/\text{hour}\)), which is, incidentally, close to the stipend amount.
fringe rate of 24 percent. There were two instructional designers, each of whom earned $47,000 per year and devoted 25 percent of their time to PATSS, for a total cost of $29,140 per year. The expenses arising from the cost of student wages, administrative support, and special-project support were provided to us directly, as seen in Table 4.1. The evaluation of PATSS (i.e., this report) cost $106,250 per year starting in AY2015.

Because hybrid classes meet partly online and not in physical classrooms, UTT saved money by reductions in the variable costs of using a classroom, which include lights, heating, ventilation, air conditioning, and cleaning. According to UTT administrators, the average classroom costs $5.20 per day to operate. Faculty responded in our 2016 survey that, on average, they spent one hour less in a classroom per week when teaching a class as PATSS compared with face-to-face. If we assume classrooms are only used once per day, the operating cost savings would be $5.20 per week (if classrooms are used more than once per day, these cost savings would be proportionately lower). That savings of $5.20 per week times 14 weeks per semester times the number of PATSS courses yields a minimum of $3,130 in savings in AY2014 to $6,261 in AY2015.

Over the course of this study, we did not observe UTT making any changes to its physical infrastructure as a result of the PATSS program. However, it is important to keep in mind that as more face-to-face courses are converted to a hybrid modality, there will be less of a need for physical classrooms. This implies that either the current stock of classrooms can be converted to other uses or UTT can continue to increase enrollment while not building new infrastructure.

Finally, as with student and faculty preferences for a hybrid modality, there is a set of impacts on UTT which are difficult to monetize, including impacts on future student demand for UTT, the quality of the faculty that UTT can hire and retain, and the overall prestige of the school.

Impacts Borne by Society

Even though we cannot quantify or monetize the impacts to society, it is important to acknowledge that they may exist.

As seen above in the impacts on students and faculty, one of the largest impacts of hybrid courses are the fact that they reduce the number of commutes by car. Fewer commutes relieve congestion on roads and reduce the negative externalities from vehicular pollution. While these impacts may be small for the PATSS program at UTT, they could be substantial if hybrid modalities are adopted at scale by universities across the United States.

At the same time, reduced visits to campus may reduce the demand for goods and services on campus, while possibly increasing demand around individual homes.

Fewer face-to-face interactions can impact the college community as a whole, because there is less time for students to interact directly with other students. In-person social networks in

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9 The average classroom is 400 square feet, and the operating cost per square foot is $0.013 per day.
college have been shown to be an important product of the college experience, and hybrid courses could reduce these important secondary benefits.

Finally, to the extent that hybrid courses differentially impact student learning outcomes or completion rates, a switch to a fully hybrid college curriculum could impact the level of positive externalities that society gains from having an educated population.

**Total Monetizable Costs for All Stakeholders**

Table 4.1 shows that the total differential monetizable costs to all stakeholders are negative in all program years, ranging between $−200,000 to $−100,000; thus, when considering only these monetizable impacts, the PATSS program had a net-positive benefit to society over the status quo of not having any PATSS courses. For summary purposes, the final column of Table 4.1 averages the four years of our study and shows an average savings of $144,808 due to PATSS. Finally, we include the last two rows in Table 4.1 to demonstrate the cost of PATSS, both without the cost of this current evaluation and on a per-student basis. The evaluation cost approximately $100,000 per year starting in AY2015; thus, the average program savings without the evaluation increases to $224,495. The average program savings per student who participated in PATSS across AYs 2014–2017 is $80. Finally, UTT administrators might be interested in the budgetary outlays incurred by the PATSS program separately from the benefits and costs that accrue to other stakeholders. Averaging across the AYs 2014 to 2017, UTT incurred $309,636 in program expenses and $229,948 in expenses if the evaluation cost is not included.
5. Conclusion

In 2013, UTT began the implementation of PATSS, which seeks to increase the use of online technologies for instruction. PATSS courses use hybrid instruction, in which a portion of a course’s classes are held face-to-face, while the remaining portion is provided asynchronously online. UTT faculty members who teach PATSS courses are required to attend an extensive training on how to create effective online material and have access to trained instructional designers to help develop their hybrid courses.

UTT asked the RAND Corporation to evaluate the PATSS program and examine whether it was indeed meeting the objectives of providing high-quality, flexible courses while improving student outcomes and reducing costs. Our evaluation methodologies were a quasi-experimental, quantitative impact evaluation; a series of qualitative evaluations that informed continuous improvement over the four years of the study; and a cost-benefit analysis that can be used to assess the efficiency and distributional impacts of the program.

Summary of Findings

Highlighting the most salient findings from our study in the subsections below, we summarize our key findings by drawing on both the qualitative and quantitative results of our work.

- There was little discernible impact of PATSS on student academic outcomes. Our analysis suggests that PATSS had no statistically discernible effect on grades in the PATSS course or in subsequent courses for which the PATSS course was a prerequisite.

- PATSS had a slightly negative impact on student course evaluations. When their course was taught as a PATSS course, students gave slightly lower overall course and instructor ratings, were less likely to prefer their course format, and were less likely to have known their course format at the time of registration.

- PATSS provided a net monetizable benefit of approximately $225,000 (or $80 per student) annually. Students experienced a net benefit from reduced commuting. Faculty had net positive benefits, stemming from negative commuting costs, but there were positive course prep costs. UTT incurred substantial budgetary costs, but the most important ones were fixed and would not be incurred again if the program were continued or scaled up.

Data-Driven Refinements to the PATSS Program

Over the course of the study, UTT took a number of actions to improve the implementation of PATSS that were informed by our research and the continuous improvement process:

- Information from student surveys and focus groups, as well as faculty focus groups, documented that during the initial years of PATSS implementation students failed to
recognize course formats in the course schedule at the time of registration. This led to surprises when students enrolled in PATSS classes and learned of the hybrid format on the first day of class. Our quasi-experimental impact analysis documented that, relative to those who were aware, students who were unaware that they had registered for a PATSS course reported lower levels of satisfaction and were more likely to report wishing their course had been delivered in another format. To address these concerns, UTT worked to clearly mark PATSS course sections as hybrid in the course schedule and developed a tag in the course-numbering system to identify PATSS courses. Our analysis did not assess whether this tag was effective, but given the relative prominence of the tag in the course schedule listing, we suspect that students were aware of the modality of the course at registration after UTT made this change.

- Qualitative data from student focus groups documented that students did not like hybrid courses delivered as voiced-over PowerPoint slide lectures and preferred professionally produced video lectures broken into digestible pieces. UTT administration worked with instructional designers and adapted PATSS training and professional development activities to ensure that faculty shifted to the preferred format.
- Faculty expressed a strong desire to have more technical training and help with developing pedagogy. Experienced PATSS faculty also expressed frustration with the more rudimentary technical training that they received in the early years of PATSS, which was oriented toward faculty who were new to hybrid courses. UTT administration worked to reorient the PATSS training and professional development opportunities to provide more-advanced technical and pedagogical training for experienced PATSS faculty and made more-rudimentary technical training available to new PATSS faculty.

Additional Recommendations for UTT

In 2017, UTT hired a new president, and the institution’s focus shifted away from PATSS. However, it is important for the university to leverage the lessons learned from the PATSS experience moving forward. We offer several suggestions:

- More-centralized authority could be useful for future institution-wide efforts to reform the implementation of online learning initiatives. Despite a strong mandate from the former UTT president, the extent of implementation of PATSS varied considerably across academic departments and colleges at UTT, and UTT administration had little control over whether and to what extent faculty engaged with the program. In future efforts that require strong institution-wide coordination, it may be useful to implement a more-centralized authority structure to ensure the reform effort is successful.
- Faculty and students could benefit from continued professional development opportunities. PATSS faculty reported positive experiences with the PATSS training and professional development opportunities, and many reported that it helped them improve their other classes as well. Given sufficient resources, UTT should consider continuing these activities.
General Findings and Lessons Learned

Over the course of our four-year study and continuous improvement process with UTT, we identified a number of more general findings and lessons learned that may be useful for other postsecondary practitioners interested in expanding the use of technology in classroom instruction. These include the following:

- **Shifting toward hybrid courses can produce savings without harming students.** Our quasi-experimental impact evaluation of PATSS demonstrated that PATSS had little impact on student course grades or grades in follow-on courses. Our cost analysis demonstrated that PATSS produced significant cost savings, largely due to reduced commuting needs for students and faculty. Taken together, these findings suggest that a wholesale shift toward well-designed and well-implemented hybrid course modalities can produce cost savings without harming students. Although we found no evidence that students performed differently in follow-on courses, our study did not assess the effects of online learning modalities on long-term student outcomes, such as graduation rates or labor market outcomes.

- **Reducing commuting needs can produce significant savings to students and faculty.** The majority of the cost savings we identified from PATSS derived from reduced commuting needs. Other efforts to reduce the need to commute to campus could produce similar savings.

- **Coordinating course schedules to allow students and faculty to benefit from reduced commuting needs is challenging.** A key challenge that UTT administration faced in implementing PATSS was coordinating course schedules to allow students and faculty to benefit from reduced commuting needs. While students may need to commute less frequently for their PATSS course, they often needed to take other courses on the day(s) the PATSS course meets online, making it difficult for them to achieve the full potential benefits of a hybrid course format. These issues may be less salient over time, if an institution were to adopt hybrid courses wholesale. However, the institution should strategically set course schedules to allow students to reduce their commuting needs.

- **Coordinating facilities and classroom space to capitalize on reduced needs can be challenging.** Another challenge that UTT experienced with PATSS was coordinating facilities and classroom space. In many cases, classrooms were allocated to a PATSS course on days when it was scheduled to meet online. In some cases, this was deliberate, as the class might meet face-to-face a handful of times on an off day during the semester. However, in many cases, the class space was assigned even though the course never met on the off day. Institutions considering shifting toward hybrid course formats should be mindful of this issue and adequately plan to ensure that they can benefit from reduced demand for classroom space.

- **Achieving faculty buy-in is difficult but crucial.** Ultimately, faculty are responsible for flipping their courses and effectively incorporating technology into their courses. Many faculty members were actively engaged in and supportive of this process, but others pushed back. Over time, as more faculty engaged in the process and reported positive experiences, more faculty became supportive. Regular PATSS training and professional development opportunities were helpful in this regard. The regular faculty and administration engagement sessions that we conducted as part of our evaluation and continuous improvement effort were also helpful.
Appendix A. Data and Methods

In this appendix, we provide more details on the databases and empirical methods that we used to quantitatively estimate the impacts of the PATSS program on student outcomes.

Data

Our administrative data come from the following files collected each semester by UTT between AY2012 and AY2017:

1. **Enrollment report, CBM001:** These files identify all students who attempted semester credit hours at UTT, along with their race, age, gender, and total credit hours received to date. We use students in this database as our base population.

2. **Faculty report, CBM008:** These files identify the courses that faculty members teach, along with the age, gender, and race of the faculty member. When more than one faculty member teaches a course (as happens in a small number of courses), we keep the faculty member with the highest-reported percentage responsibility. In the few cases where responsibility is evenly distributed, we choose one faculty member at random to assign the course-section.

3. **Student schedule report, CBM00S:** These files identify transcript-level information for all students who completed a course. They identify the level of the course taken and the grade received in the course.

4. **EOC question responses:** These files identify the responses to EOC questions that are asked of students each quarter. The questions are determined by the UTT Faculty Senate and change periodically. Students are not required to answer these questions.

5. **Course sections taught in the PATSS modality:** In each semester, PATSS program administrators compiled a list of each course taught in the PATSS hybrid modality. We merge these databases using the anonymized student and faculty identifiers, as well as the UTT-defined subject-course-section numbers.

Methodology

Our empirical approach uses a fixed effect regression model of the following form:

\[ Y_{i,f,c,s,t} = \beta \text{PATSS}_{f,c,s} + \gamma_{f,c} + \lambda_i + \mu_t + \epsilon_{i,f,c,s,t} \]

where \( Y_{i,f,c,s,t} \) is the learning outcome, either grade points earned or responses to EOC questions, which varies across students \( i \) taught by faculty \( f \) in course \( c \), section \( s \), and semester-year \( t \). PATSS\(_{f,c,s}\) is a binary indicator for courses that are taught in the PATSS hybrid modality as opposed to traditional face-to-face modality. \( \gamma_{f,c} \) are fixed effects for each faculty-course, \( \lambda_i \) are fixed effects for students, \( \mu_t \) are fixed effects for semester-years, and \( \epsilon_{i,f,c,s,t} \) is an error term. Standard errors of coefficient estimates are clustered at the section level to account for correlation in the outcomes within a class. The coefficient of interest is \( \beta \), which identifies the
differential impact of PATSS to face-to-face teaching for a given faculty member in a given course. In some models, we replace the PATSS indicator with separate indicators for PATSS courses in each academic year in order to investigate whether there were different impacts as the program scaled up and matured.

Results

Main Impact of PATSS on Course Grades

Table A.1 presents the main results of the impact of PATSS on course grades. The three columns in the center contain estimates from models which disaggregate the impact in each of the four academic years of study. These columns also demonstrate the importance of using our fixed effect methodology by successively adding fixed effects for students and faculty-by-course.

Table A.1. The Impact of PATSS on Grade Points

<table>
<thead>
<tr>
<th>Outcome = PATSS course in AY</th>
<th>Grade point (1)</th>
<th>Grade point (2)</th>
<th>Grade point (3)</th>
<th>Grade point (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AY 2014</td>
<td>0.0271</td>
<td>-0.0135</td>
<td>0.00340</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0796)</td>
<td>(0.0578)</td>
<td>(0.0503)</td>
<td></td>
</tr>
<tr>
<td>AY 2015</td>
<td>-0.00477</td>
<td>-0.118**</td>
<td>0.0211</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0595)</td>
<td>(0.0533)</td>
<td>(0.0470)</td>
<td></td>
</tr>
<tr>
<td>AY 2016</td>
<td>-0.122**</td>
<td>-0.149***</td>
<td>0.0263</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0572)</td>
<td>(0.0491)</td>
<td>(0.0397)</td>
<td></td>
</tr>
<tr>
<td>AY 2017</td>
<td>-0.120**</td>
<td>-0.0795</td>
<td>0.0807**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0583)</td>
<td>(0.0485)</td>
<td>(0.0365)</td>
<td></td>
</tr>
</tbody>
</table>

PATSS course                  |                 |                 |                 | 0.0322          |
|                             |                 |                 |                 | (0.0281)        |

Semester-year fixed effects   | Yes             | Yes             | Yes             | Yes             |
Student fixed effects         | Yes             | Yes             | Yes             | Yes             |
Faculty-by-course fixed effects|                 |                 |                 |                 |

Observations: 139,660         138,126         138,126         138,126
R-squared: 0.005              0.499            0.612            0.612

NOTES: *** p < 0.01, ** p < 0.05, * p < 0.1. Observations are at the student-course level. Only subjects which had any PATSS courses are included. Sample includes only undergraduate students in undergraduate courses between AY2012 and Fall of AY2017. Grade points range from 0 to 4. Standard errors in parentheses clustered at the semester-year-segment level.
The Grade Point (1) column controls only for time-specific trends in course grades through the use of semester-year fixed effects, and thus the coefficients reflect the unconditional differences in average grade points between PATSS and face-to-face courses for each academic year. Point estimates in all academic years are either indistinguishable from zero or significantly negative. The largest point estimate, −0.122 in AY2016, indicates that students in PATSS sections earned 0.122 grade points less than students in non-PATSS sections. Importantly, this specification does not account for the fact that certain courses were systematically chosen to be a part of the PATSS program, and it may be that students would have earned lower grades in those courses regardless of the delivery modality. This specification also does not account for the possibility that more- or less-able students could systematically take PATSS courses, an issue which is addressed in column 2 with the inclusion of student fixed effects.

The addition of student fixed-effects in column 2 only marginally changes the PATSS coefficients, which may be reflecting the fact that students are not systematically selecting into different course modalities. On the other hand, the inclusion of faculty-by-course fixed effects in column 3 leads to larger changes in the PATSS coefficients, with positive, yet insignificant, point estimates for AYs 2014 through 2016 and a positive and significant impact of 0.08 grade points in AY2017. The results in column 3 suggest that any negative effects of PATSS shown in columns 1 and 2 are more related to the specific courses that have been transitioned into online formats (perhaps more difficult courses), rather than the actual effects of the modality (online versus face to face). By including faculty-course fixed effects, the results in column 3 show differences in outcomes between PATSS and face-to-face, for the same course and faculty member. Column 4 pools all of the academic years and shows PATSS had a positive yet insignificant impact on course grades of 0.03 grade points. This pooled model increases the precision of the point estimate (i.e., reduces the standard error) but also reflects a weighted average of the four disparate coefficients seen in column 3.

Overall, the evidence from Table A.1 suggests that there were not large impacts of PATSS courses on student grades. Even the largest impacts seen in AY2017—of 0.08 percent—represent only a small change on the zero to four grade-point scale. Importantly, however, we can also rule out large negative impacts on grades of the PATSS modality, compared with those of face-to-face instruction.

Subgroup Analyses

The PATSS hybrid modality may be more or less effective among students with different amounts of college experience, and so we estimate the impact of PATSS within each class (freshmen, sophomores, juniors, and seniors, as defined by students’ cumulative credit hours). Columns 1–4 of Table A.2 contain these estimates, pooling across all academic years (the same

10 The sample size drops slightly when student fixed effects are included, as we must exclude the few students who took only one course.
conclusions result disaggregating across years), yet no estimates are significantly different from zero.

Hybrid courses may also be more or less suited to different levels of academic difficulty, and so we estimate the impact of PATSS by course level (100-, 200-, 300-, and 400-level courses). Columns 5–8 of Table A.2 show that students do equally well in PATSS compared with face-to-face modality in 100- and 200-level courses, but they do slightly better in PATSS versions of 300- and 400-level courses, by 0.07 and 0.06 grade points, respectively (again, results are similar when looking separately at academic years).

Table A.2. The Impact of PATSS by Academic Class and Course Level

<table>
<thead>
<tr>
<th>Class =</th>
<th>By class</th>
<th>By level of course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome =</td>
<td>Freshman</td>
<td>Sophomore</td>
</tr>
<tr>
<td>Grade Points</td>
<td>Grade Points</td>
<td>Grade Points</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>PATSS course</td>
<td>0.126</td>
<td>-0.0451</td>
</tr>
<tr>
<td>(0.102)</td>
<td>(0.0458)</td>
<td>(0.0433)</td>
</tr>
</tbody>
</table>

Semester-year, Student, and Faculty-by-course FE

Simple Year, Student, and Faculty-by-course FE

Observations | 23,478 | 16,084 | 50,813 | 37,899 | 20,850 | 20,072 | 38,244 | 56,658 |

NOTES: FE = fixed effects. *** p < 0.01, ** p < 0.05, * p < 0.1. Observations are at the student-course level. Only subjects which had any PATSS courses are included. Sample includes only undergraduate students in undergraduate courses between AY 2012 and Fall of AY 2017. Grade points range from 0 to 4. Standard errors in parentheses clustered at the semester-year-segment level.

**Impact in Follow-On Courses**

One criticism of using course grades to measure the impacts of PATSS is that faculty could systematically tailor their course grades to the instruction modality. Another criticism is that the current course grade does not capture long-run gains in learning. One way to address both of these concerns is to study the impact of the PATSS modality on a student’s performance in a follow-on course.

For this exercise, we compiled a list of all UTT courses which had a direct and natural follow-on course—for example, Calculus 1 into Calculus 2 or Introductory Microeconomics into Intermediate Microeconomics. We then restricted the sample to only these follow-on courses and regressed a student’s grade in the follow-on course on an indicator of whether the student took a PATSS version of the prerequisite. We cannot include student fixed effects in such a model, so we instead control for the student’s cumulative GPA and the grade received in the prerequisite.
course. As with our main specification, we include semester-year and faculty-by-course fixed effects.

Table A.3 contains the results for all students (column 1), by class (columns 2–5), and by course level (columns 6–8). Overall, there is no significant impact of having taken a PATSS prerequisite on the grade received in the follow-on courses (the estimate is 0.016 grade points). There is also little evidence that this null effect varies across students’ academic experiences or the difficulty of the course. The one significant estimate is for 300-level courses, with a point estimate of −0.226, signaling that PATSS students may have not been as prepared as students who took the prerequisite face-to-face. However, note that this is an extremely small sample, of only 522 students.

### Table A.3. The Impact of PATSS on Follow-On Courses

<table>
<thead>
<tr>
<th>Outcome =</th>
<th>All students</th>
<th>Freshman</th>
<th>Sophomore</th>
<th>Junior</th>
<th>Senior</th>
<th>100 level</th>
<th>200 level</th>
<th>300 level</th>
<th>400 level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Points</td>
<td>0.0161</td>
<td>0.0521</td>
<td>-0.0320</td>
<td>0.0415</td>
<td>-0.0253</td>
<td>0.0985</td>
<td>-0.0194</td>
<td>-0.226***</td>
<td>0.0462</td>
</tr>
<tr>
<td>(0.0288)</td>
<td>(0.0524)</td>
<td>(0.0796)</td>
<td>(0.0692)</td>
<td>(0.0443)</td>
<td>(0.0606)</td>
<td>(0.0595)</td>
<td>(0.0801)</td>
<td>(0.0408)</td>
<td></td>
</tr>
<tr>
<td>Control for GPA and pre-req grade</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Semester-year and Faculty-by-course FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>9,533</td>
<td>4,282</td>
<td>1,517</td>
<td>1,120</td>
<td>2,580</td>
<td>3,905</td>
<td>2,466</td>
<td>522</td>
<td>2,640</td>
</tr>
</tbody>
</table>

**NOTES:** *** p < 0.01, ** p < 0.05, * p < 0.1. Observations are at the student-course level. Only subjects which had any PATSS courses are included. Sample includes undergraduates between AY2012 and fall of AY2017 who are taking the follow-on course to a course that had at least one section taught as a PATSS class. Grade points range from 0 to 4.

**Impact of PATSS on EOC Evaluations**

Table 2.3 showed that, on average, only 65 percent of students filled out their EOC evaluations. In order to assess whether the decision to answer the questions was related to the course modality, we regressed an indicator of answering the questions on the PATSS course indicator in our faculty-by-course, student, and time fixed effect model. The coefficient on PATSS is a robust zero, which helps rule out the concern that our estimates of the impact of PATSS on student opinions are being driven by self-selection.

Table A.4 presents the impacts of PATSS on EOC survey questions. For all questions, students in PATSS sections scored the course less favorably, and most of these negative coefficients are significantly different from zero. For example, when answering whether the
course was well organized, students in the PATSS version scored the course 0.168 points lower on a scale of one to five. Despite the significantly negative impacts, these estimates are relatively small in magnitude.

Table A.4. The Impact of PATSS on EOC Survey Questions

<table>
<thead>
<tr>
<th>End-of-course question</th>
<th>PATSS course (standard error)</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course was well organized</td>
<td>-0.168*** (0.0407)</td>
<td>59,422</td>
</tr>
<tr>
<td>Tests/assignments were usually graded and returned promptly.</td>
<td>-0.0297 (0.0325)</td>
<td>59,275</td>
</tr>
<tr>
<td>Instructor made me feel free to ask questions, disagree, and express my ideas</td>
<td>-0.0546* (0.0301)</td>
<td>59,328</td>
</tr>
<tr>
<td>Overall, this instructor was excellent.</td>
<td>-0.0283 (0.0301)</td>
<td>92,547</td>
</tr>
<tr>
<td>Overall, this course was excellent.</td>
<td>-0.0750** (0.0362)</td>
<td>76,025</td>
</tr>
<tr>
<td>Instructor was readily available to me.</td>
<td>-0.0014 (0.0247)</td>
<td>87,035</td>
</tr>
<tr>
<td>Instructor used a variety of effective teaching methods and activities that help</td>
<td>-0.127*** (0.0410)</td>
<td>53,946</td>
</tr>
<tr>
<td>Instructor was very interested and enthusiastic about the subject matter.</td>
<td>-0.0455* (0.0273)</td>
<td>53,975</td>
</tr>
<tr>
<td>Instructor clearly defined and explained the course objectives and expectations</td>
<td>-0.0476* (0.0276)</td>
<td>66,634</td>
</tr>
<tr>
<td>Instructor was prepared for each instructional activity.</td>
<td>-0.0389 (0.0285)</td>
<td>66,633</td>
</tr>
<tr>
<td>Instructor communicated information effectively.</td>
<td>-0.0578* (0.0337)</td>
<td>66,633</td>
</tr>
<tr>
<td>Instructor encouraged me to take an active role in my own learning.</td>
<td>0.00101 (0.0223)</td>
<td>66,633</td>
</tr>
<tr>
<td>Instructor adhered to syllabus &amp; was clear about any changes.</td>
<td>-0.0791** (0.0351)</td>
<td>33,474</td>
</tr>
<tr>
<td>Knew format of course at registration</td>
<td>-0.0948*** (0.0160)</td>
<td>31,485</td>
</tr>
<tr>
<td>Hours each week spent studying for this class</td>
<td>-0.0134 (0.0344)</td>
<td>32,709</td>
</tr>
<tr>
<td>Times each week met face-to-face with the instructor</td>
<td>-0.450*** (0.0908)</td>
<td>23,919</td>
</tr>
<tr>
<td>Hours each week met face-to-face with the instructor</td>
<td>-0.550*** (0.0717)</td>
<td>23,918</td>
</tr>
<tr>
<td>Offered modality was the most preferred</td>
<td>-0.149*** (0.0337)</td>
<td>23,113</td>
</tr>
</tbody>
</table>

NOTES: *** p < 0.01, ** p < 0.05, * p < 0.1. Each row is a separate regression which includes an indicator for subsequent faculty-course-semesters of a PATSS course and student, year, and faculty-by-course fixed effects. Not all questions were asked in every quarter. Responses to questions were not mandatory. This list includes all end-of-course questions that were asked in at least one PATSS course. Regular UTT questions can take integer values between 1 and 5. Times per week face-to-face, hours per week face-to-face, and study hours per week questions were truncated at 4.

Perhaps not surprisingly, students in PATSS sections were 9.5 percentage points less likely to know the format of the course at the time of registration. Students in PATSS sections did not spend different amounts of hours studying than they might in face-to-face sections (an insignificant −0.013 hours), but they did meet with the instructor for fewer hours (0.55 fewer hours) and fewer times (0.45 fewer) per week than intended by the program.

We asked the final question about whether the student believed the offered modality was their most preferred in order to capture directly students’ preferences over teaching modality. While overall 67 percent of students preferred the modality they had, PATSS students were 14.9 percentage points more likely to prefer either a face-to-face or an online version of the course instead of the hybrid version they took.
It is reasonable to believe that students have a preferred teaching modality, and so we next replicate the analyses presented in Table A.4 for the 95 percent of students who knew the course modality upon registration. Table A.5 contains these results. Not surprisingly, students in PATSS sections have views of the instructor and course that are now indistinguishable from those in face-to-face sections. For one outcome—“Instructor encouraged me to take an active role in my own learning”—PATSS students gave a rating 0.088 points higher than that assigned by face-to-face students. Interestingly, however, there were still 11.2 percent of students in this sample who would have preferred the course was taught as either face-to-face or fully online.

Table A.5. EOC Questions Among Students Who Knew the Course Modality upon Registration

<table>
<thead>
<tr>
<th>End of Course evaluation (1 to 5 scale)</th>
<th>PATSS course</th>
<th>standard error</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Regular UTT questions</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course was well organized</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests/assignments were usually graded</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and returned promptly.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor made me feel free to ask</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>questions, disagree, and express my</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ideas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall, this instructor was excellent.</td>
<td>0.0689</td>
<td>(0.0462)</td>
<td>29,973</td>
</tr>
<tr>
<td>Overall, this course was excellent.</td>
<td>0.00509</td>
<td>(0.0692)</td>
<td>14,964</td>
</tr>
<tr>
<td>Instructor was readily available to me.</td>
<td>0.0434</td>
<td>(0.0421)</td>
<td>29,973</td>
</tr>
<tr>
<td>Instructor used a variety of effective</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>teaching methods and activities that</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>help.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor was very interested and</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enthusiastic about the subject matter.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor clearly defined and</td>
<td>0.0301</td>
<td>(0.0427)</td>
<td>29,974</td>
</tr>
<tr>
<td>explained the course objectives and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>expectations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor was prepared for each</td>
<td>0.0127</td>
<td>(0.0405)</td>
<td>29,974</td>
</tr>
<tr>
<td>instructional activity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor communicated information</td>
<td>0.0281</td>
<td>(0.0471)</td>
<td>29,974</td>
</tr>
<tr>
<td>effectively.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor encouraged me to take a</td>
<td>0.0881**</td>
<td>(0.0375)</td>
<td>29,974</td>
</tr>
<tr>
<td>active role in my own learning.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor adhered to syllabus &amp; was</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>clear about any changes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Questions designed for PATSS study</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(asked in all courses, regardless of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>modality)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knew format of course at registration</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours each week studying for this class</td>
<td>-0.0339</td>
<td>(0.0359)</td>
<td>29,973</td>
</tr>
<tr>
<td>Times each week met face-to-face with</td>
<td>-0.406***</td>
<td>(0.0882)</td>
<td>21,609</td>
</tr>
<tr>
<td>the instructor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours each week met face-to-face with</td>
<td>-0.518***</td>
<td>(0.0697)</td>
<td>21,610</td>
</tr>
<tr>
<td>the instructor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offered modality was the most preferred</td>
<td>-0.112***</td>
<td>(0.0354)</td>
<td>21,041</td>
</tr>
</tbody>
</table>

NOTE: Each row is a separate regression which includes an indicator for subsequent faculty-course-semesters of a PATSS course and student, year, and faculty-by-course fixed effects.
Appendix B. Qualitative Data Instruments

Student Survey (Year 1 and 4)

Q1 HYFlex: Online and Hybrid PATSS Course Evaluation
The University of Texas Institutional Review Board #2014-49; approved November 4, 2014
The Center for Teaching Excellence and Innovation at the University of Texas at Tyler would like you to take a few minutes to complete the following survey about your perceptions on improving hybrid and online courses. This survey is completely anonymous. No anticipated risks are expected through your participation in this study, and participation is completely voluntary, and you are free to stop at any time without any undue consequences. Answering any of the questions is completely voluntary. If you have any questions concerning participation in this project, you may contact the principal researcher:
Julie Delello, Ph.D., Director for the Center for Excellence in Teaching and Learning
jdelello@uttyler.edu
The University of Texas at Tyler
Tyler, Texas 75799

I have read, understood, and printed a copy of, the above consent form and desire of my own free will to participate in this study.

a. Yes (1)
b. No (2)

Q2 What is your gender?
   a. Male (1)
   b. Female (2)
Q3 What was your age as of January 1, 2014?

▼ 18 (18) ... 100 or over (100)

Q4 What is your ethnicity?
   a. White/Caucasian (1)
   b. Black or African American (2)
   c. Hispanic or Latino (3)
   d. Asian (4)
   e. Native American or Alaska Native (5)
   f. Pacific Islander (6)
   g. Other (7) ____________________________________________

Q5 Do you live on campus?
   a. Yes (1)
   b. No (2)

Skip To: Q9 If Do you live on campus? = Yes
Skip To: Q6 If Do you live on campus? = No
Q6 How do you regularly commute to campus?
   a. Drive (1)
   b. Carpool (2)
   c. Use Public Transportation (Bus System, TAXI) (3)
   d. Use UTTyler Bus System (4)
   e. Walking (5)
   f. Biking (6)
   g. Other (7) ________________________________________________

Q7 How much time does it take you to commute to school one way?
   a. 0–10 minutes (1)
   b. 11–20 minutes (2)
   c. 21–30 minutes (3)
   d. 31–60 minutes (4)
   e. more than one hour (5)

Q8 How many miles is your commute one way?
   a. 0–3 miles (1)
   b. 4–7 miles (2)
   c. 8–15 miles (3)
   d. 16–30 miles (4)
   e. 31–50 (5)
   f. More than 50 miles (6)

Q9 Please choose the PATSS HYFlex courses you are currently enrolled in.
   a. EDUC-3356.001 (11)
   b. EDUC-1301.002 (13)
   c. EDUC-4365.001 (12)
   d. READ-3330.001 (14)
   e. READ-3330.002 (16)
   f. ELED-4314.001 (18)
   g. EPSY-3330.001 (17)
   h. EDUC-3356.001 (7)
   i. ELED-4314.001 (9)
   j. PSYC-4315.060 (19)
   k. PSYC-3311.060 (22)
   l. PSYC-3310.060 (23)
   m. PSYC-3306.060 (24)
   n. FINA-4310.001 (25)
   o. MANA-4395.001 (26)
p. ACCT-3325.002 (29)
q. CRIJ-4333.001 (30)
r. CRIJ-4322.002 (31)
s. ALHS-4320.001 (32)
t. ALHS-3362.001 (33)
u. ALHS-4304.001 (34)
v. ALHS 4333.001 (35)
w. HECC-4308.001 (36)
x. HECC-4333.002 (38)
y. KINE-3303.001 (39)
z. KINE-3303.002 (40)
aa. KINE-3334.001 (41)
bb. KINE-3334.002 (42)
cc. CMGT-4335.001 (43)

dd. CMGT-2303.001 (44)
ee. CMGT-3310.001 (45)
ff. CMGT-3311.001 (46)
gg. CMGT-2302.001 (47)

hh. CMGT-4375.001 (48)
ii. ENGL-2362.001 (49)
jj. POLS-2306.003 (50)
kk. POLS-2306.002 (51)
ll. HIST-1302.001 (52)
mm. HIST-1301.003 (53)

nn. POLS-5300.001 (54)
oo. POLS-2305.005 (56)
pp. POLS-5330.001 (57)
qq. MARK-5320.001 (58)
rr. NURS-3611.001 (59)
ss. NURS-4501.001 (60)
tt. NURS-3513.063 (61)
uu. NURS-3310.063 (62)
vv. NURS-4631.070 (63)
ww. NURS-3307.070 (64)
xx. NURS-4723.070 (65)
yy. NURS-3603.070 (66)
zz. NURS-4501.070 (67)

aaa. Other (69)
Q10 By taking the PATSS course [COURSE TITLE], how many times per week did you NOT have to commute to school?
   a. (1)
   b. (2)
   c. (3)
   d. (4)
   e. (5)
   f. (6)
   g. (7)

Q11 Relative to past or current face-to-face courses, how would you rate this PATSS course in terms of:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction and engagement with other students in the class? (2)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

Q12 Relative to past or current face-to-face courses, how would you rate this PATSS course in terms of academic rigor?
   a. Much more rigorous/difficult (1)
   b. Moderately more rigorous/difficult (2)
   c. Equally as rigorous/difficult (3)
   d. Moderately less rigorous (4)
   e. Much less rigorous/difficult (5)

Q13 In terms of this PATSS course, please rank the following:

<table>
<thead>
<tr>
<th>This course allowed me to control the pace of my own learning. (1)</th>
<th>Strongly Disagree (11)</th>
<th>Disagree (12)</th>
<th>Neither Agree nor Disagree (13)</th>
<th>Agree (14)</th>
<th>Strongly Agree (15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course allowed me to better organize my time. (2)</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
</tbody>
</table>

53
Q14 PATSS courses strive to utilize new and state-of-the-art technology to deliver instruction and facilitate effective communication and interaction with students and faculty. In general, how easy was it for you to access and utilize the technology in your PATSS course?
   a. Extremely easy to access and use (1)
   b. Moderately easy to access and use (2)
   c. Neither easy nor difficult to access and use (3)
   d. Moderately difficult to access and use (4)
   e. Extremely difficult to access and use (5)

Q15 If you had your choice, please which type of class would you prefer taking?
   a. Face-to-Face (1)
   b. Hybrid (HyFlex) (2)
   c. Online (3)

Q16 Please provide any additional information about your experience in the PATSS HYFlex courses.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Q17 UTT is currently conducting a study of the implementation and impact of the PATSS Program at UTT. As part of the study, the research team would like to conduct student focus groups to gain a better understanding of student experiences in PATSS courses and to understand what might help improve the program. If you would be willing to participate in a focus group,
for a chance to win a Target gift card, please send your name and email address to jdelello@uttyler.edu

Student and Faculty Focus Group Protocols (2015)

Introduction by Facilitator

Hello, my name is Dr. Julie Delello. I am an Assistant Professor here at the University of Texas at Tyler. Thank you for taking the time to participate in this focus group. The goal of this meeting is to better understand the needs of [faculty, students] across colleges and universities in regards to hybrid or online course development. I am specifically wanting to talk with [faculty, students] who have taken a PATSS course.

Before we begin, I want to take a moment to make sure I have your full consent. [Read consent form here.]

[Once consent forms are completed and turned in] Are there any additional questions before we begin?

Thank you for your consent. Today, I am here because I would like to hear from you about the ways in which the PATSS courses/classes have met your needs and also the changes you would suggest so that they could better meet your needs. During this focus group I will ask questions and facilitate a conversation about how the University of Texas at Tyler might be able to help you achieve your future goals. Please keep in mind that there are no “right” or “wrong” answers to any of the questions I will ask. The purpose is to stimulate conversation and hear the opinions of everyone in the room. Please feel free to speak freely and give your honest opinion.

Focus Group Questions for Students

- Please introduce yourself.
- Why did you take a PATSS course (online or hybrid)?
- What are the advantages of taking an online or hybrid (PATSS) course compared to a face-to-face course?
- What are some of the challenges when taking an online or hybrid (PATSS) class compared to a face-to-face course?
- What types of technology did your professor use in your PATSS course? (PROBE: Were they helpful? Suggestions on what technologies should be used?)
- How did you interact with the professor in your PATSS course? (PROBE: discussion boards, feedback on work?)
- How did you interact with other students in your PATSS course? (PROBE: online forums)
- What were your assignments like in PATSS courses? How do they compare to assignments you’ve had in face-to-face classes?
- Relative to a face-to-face class, would you say that the PATSS course better fit with your life or work demands? If so, how?
- Is there anything else we haven’t discussed yet that you think is important for the university to know about as we consider the development of hybrid or online courses?
Thank you!

**Focus Group Questions for Faculty**

- Please introduce yourself.
- How did you first learn about PATSS? What was your initial impression of PATSS? Has your impression changed as you’ve experienced the program?
- Why did you decide to create/teach a PATSS course (online or hybrid)?
- What resources did you use to develop or teach your PATSS course (PROBE: Instructional manuals, other faculty, outside resources)? Was the PATSS training beneficial? Why or why not?
- What are some of the challenges in developing or teaching a PATSS class? How did the instructional designer—if you had one—help you to address these challenges?
- What were the advantages of teaching an online or hybrid (PATSS) course versus a face-to-face course?
- How did you interact with the students in your PATSS courses?
- How did you integrate and use technology into your PATSS class? (PROBE: components)
- What additional resources do you think you would you need for your PATSS class? Improve your teaching? (PROBE: technology, training)
- If you taught a face-to-face version of the course, did you change course content, how you teach, or the types of assignments you gave students in your PATSS class? If so, how?
- Is there anything else we haven’t discussed yet that you think is important for the university to know about as we consider the future development of hybrid or online courses?

Thank you for participating in this focus group.

**Questions Added to the End-of-Course Student Evaluation (Fall 2015–Spring 2017)**

1. Classes at UTT are delivered in a variety of formats including classroom-based, online, and hybrid (e.g. a combination of classroom-based and online). Did you know the format of this course when you registered?
   - Yes
   - No
   - Unsure

2. What format for this course would you have most preferred?
   - Classroom-based
   - Online
   - Hybrid
   - Team-based Learning
   - Unsure
3. How many TIMES per week, on average, did this class meet the instructor face-to-face in a classroom for instruction?

- 0
- 1
- 2
- 3
- 4 or more

4. How many HOURS per week, on average, did this class meet the instructor face-to-face in a classroom for instruction?

- 0
- 1
- 2
- 3
- 4 or more

5. On average, how many HOURS per week did you spend online for this course for instructional purposes?

- 0
- 1
- 2
- 3
- 4 or more

Spring 2016 PATSS Faculty Survey (2016–2017)

Q1 The RAND Corporation and the University of Texas at Tyler would like you to take a few minutes to complete the following survey about your perceptions on improving hybrid and online (PATSS) courses. This survey is completely anonymous. No anticipated risks are expected through your participation in this study; participation is completely voluntary and you are free to stop at any time without any undue consequences. The research has been approved by the University of Texas at Tyler’s Institutional Review Board (IRB #2015-50). If you have any questions concerning participation in this project, you may contact the principal researchers:

- Trey Miller, Ph.D., Jesse Cunha, Ph.D., Rafiq Dossani, Ph.D.

- The RAND Corporation

- Julie Delello, Ph.D., jdelello@uttyler.edu

- School of Education, The University of Texas at Tyler, Texas 75799

I have read, understood, and printed a copy of the above consent form and desire of my own free will to participate in this study.

a. Yes (1)
Skip To: End of Block
If the RAND Corporation and the University of Texas at Tyler would like you to take a few minutes to . . . = Yes

Skip To: End of Survey
If the RAND Corporation and the University of Texas at Tyler would like you to take a few minutes to . . . = No

Q2 Have you ever taught a PATSS course?
   a. yes (1)
   b. no (2)

Skip To: Q3
If Have you ever taught a PATSS course? = yes

Skip To: End of Survey
Have you ever taught a PATSS course? = no

Q3 What is your gender?
   a. Male (1)
   b. Female (2)

Q4 Please indicate the highest level of education completed.
   a. Bachelor’s Degree (7)
   b. Master’s Degree (5)
   c. Doctoral/Professional Degree (6)
   d. Other (10)

Q5 How many years of teaching experience do you have in higher education?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>30</th>
<th>36</th>
<th>42</th>
<th>48</th>
<th>54</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>(</td>
<td></td>
<td>6</td>
<td>12</td>
<td>18</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>42</td>
<td>48</td>
<td>54</td>
<td>60</td>
</tr>
</tbody>
</table>

Q6 What is your current position?
   a. Lecturer or Teaching Professor (1)
   b. Visiting Professor (2)
   c. Adjunct Professor (3)
   d. Assistant Professor (4)
   e. Associate Professor (5)
f. Full Professor (6)

Q7 Which college are you primarily employed in?
   a. College of Arts and Sciences (6)
   b. College of Business and Technology (3)
   c. College of Education and Psychology (2)
   d. College of Engineering (5)
   e. College of Nursing and Health Sciences (1)
   f. College of Pharmacy (4)
   g. University College (12)

Q8 What is your average yearly salary at UTT?
   a. Below $20,000 (1)
   b. $20,000 - $29,999 (2)
   c. $30,000 - $39,999 (3)
   d. $40,000 - $49,999 (4)
   e. $50,000 - $59,999 (5)
   f. $60,000 - $69,999 (6)
   g. $70,000 - $79,999 (9)
   h. $80,000 - $89,999 (7)
   i. $90,000 or more (8)

Q9 When did you first teach a PATSS course?
   a. 2013 Fall (1)
   b. 2014 Spring (2)
   c. 2014 Fall (3)
   d. 2015 Spring (4)
   e. 2015 Fall (5)
   f. 2016 Spring (6)

Q10 How many PATSS courses have you taught in total (include duplicate sections)?

   | 0 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
---|---|---|----|----|----|----|----|----|----|----|----|

Q11 How many PATSS training programs have you attended?

Not Applicable

0 2 4 6 8 10 12 14 16 18 20

*Skip To: Q14 If How many PATSS training programs have you attended? ( ) Is Empty*

Q12 Please indicate how well the PATSS trainings met your expectations.

<table>
<thead>
<tr>
<th>Far short of expectations (69)</th>
<th>Short of expectations (70)</th>
<th>Just met my expectations (73)</th>
<th>Exceeds expectations (71)</th>
<th>Far exceeds expectations (72)</th>
</tr>
</thead>
</table>

Q13 What suggestions do you have to improve future trainings?

________________________________________________________________
________________________________________________________________
________________________________________________________________

Q14 Now, we would like you to consider the last PATSS course you taught (if you taught more than one PATSS course in the last semester you taught a PATSS course, choose one). Several of the questions that follow will ask you to compare your experience with this PATSS course to what it would have been like if the course had been a traditional face-to-face course. Have you ever taught this course in a traditional face-to-face setting?

a. yes (1)

b. no (2)

Q15 If you had taught this class as face-to-face in the past, approximately how many hours did it take to prepare it to teach as a PATSS course?

Not Applicable
Q16 If you have not taught this class in the past, approximately how many hours did it take to prepare to teach it as a PATSS course?

Not Applicable

Q17 How many hours did you spend per week in total teaching this PATSS course (including delivery, preparation, advising, grading)?

Q18 If you had instead taught this course fully face-to-face, how many hours do you believe you would have spent per week in teaching (including delivery, preparation, advising, grading)?

Not Applicable

Q19 How many hours did you spend working with an Instructional Designer to build your course?
Q20 If you have to update this course in the future, how much time do you estimate it will take to update the course (in hours)?

Not Applicable

Q21 If this course were to be taught face-to-face instead of as a PATSS course, how much time would it take to update the face-to-face version of the course (in hours)?

Not Applicable

Q22 How much math was required for this course?

No math (1)  Some math (2)  Mostly math based (3)

Q23 To what extent do you agree or disagree with the following statements?

I would prefer to teach more PATSS courses (assuming
that my course load remains the same) (6) I would like to convert more face-to-face courses to PATSS courses. (11) Students prefer to take the course I taught as a PATSS course rather than as face-to-face. (2) Participation in the PATSS program has benefited my teaching in other classes. (14)

<table>
<thead>
<tr>
<th>Q24 Click to write the question text</th>
<th>Much worse (1)</th>
<th>Slightly worse (3)</th>
<th>About the same (4)</th>
<th>Slightly better (5)</th>
<th>Much better (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel that the quality of the course is as a PATSS course than a face-to-face course. (1) Students like PATSS courses ______ than face-to-face courses. (11) Students’ learning experience was ______ in this PATSS course than if the course had been taught face-to-face. (12) Students develop problem-solving skills ______ in a PATSS course than in a face-to-face course. (13) Students develop conceptual thinking ______ in a PATSS course than in a face-to-face course. (14) Students develop technical skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q25 We are interested to know if you were allocated classroom space for your PATSS course that you did not need to use. How many hours per week was there an empty classroom that was assigned to you?

0  2  4  6  8  10  12  14  16  18  20

Q26 How many less times per week did you have to commute to campus because this was a hybrid (part online, part face-to-face) rather than a face-to-face course?

0  2  4  6  8  10  12  14  16  18  20

Q27 In general, to what extent does teaching at least one PATSS course in a semester allow you to reduce your commuting time?
Q28 How much time in minutes does it typically take for you to commute to campus one-way?

0 12 24 36 48 60 72 84 96 108 120

Q29 How many miles is your average commute to work (one-way)?

0 12 24 36 48 60 72 84 96 108 120

Q30 Is there anything else you would like to tell us about your experience developing and teaching PATSS courses?
Appendix C. Estimating the Impact of Hybrid Courses on Commuting Behavior

In order to estimate the reduced number of commutes that students make due to hybrid courses, we estimate a series of regressions with the number of commutes per week as the dependent variable and the percentage of courses taken in hybrid modality as the main independent variable.

These regressions also control for the total number of courses taken in a semester, whether the student drives to campus, the student’s commuting time, the student’s hourly wage, the student’s gender, and fixed effects for the year in college (freshman, sophomore, junior, or senior) and the college within UTT to which the student belongs. Observations are at the student level and include only those students who lived off campus and took at least one hybrid course. Thus, we are leveraging the variation across students who take different percentages of their course load in hybrid courses. On average, students take four courses per semester, and so we predict the impact of converting one of the face-to-face courses to a hybrid course by multiplying the estimated coefficient on “[percentage] of courses taken in hybrid modality” by 0.25.

Table C.1 contains the estimation results. Columns 1 and 2 include all commuters, while columns 3 and 4 only include those who commute by car. The odd columns use the 2015 commuting survey, while the even ones use the 2017 commuting survey. All coefficient estimates on the percentage of hybrid courses are negative, indicating that a higher percentage of hybrid courses decreases the number of commutes. For example, in 2017, among respondents who drove to campus (column 4), a 25 percent increase in the percentage of hybrid courses leads to 0.42 fewer commutes.
Table C.1. Regression Estimates of the Impact of PATSS Hybrid Courses on Commuting Behavior

<table>
<thead>
<tr>
<th>Sample:</th>
<th>All off-campus students who took at least one hybrid course</th>
<th>Off campus drivers who took at least one hybrid course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey year:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Commutes per week</td>
<td>2017</td>
</tr>
<tr>
<td>Outcome:</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>% of hybrid classes [# hybrid / (# hybrid + # face-to-face)]</td>
<td>-1.489</td>
<td>-1.207**</td>
</tr>
<tr>
<td>Total number of classes [# hybrid + # face-to-face]</td>
<td>0.0590</td>
<td>0.225**</td>
</tr>
<tr>
<td>Drives to campus</td>
<td>-0.0512</td>
<td>0.622</td>
</tr>
<tr>
<td>Commuting time (hours)</td>
<td>-0.864***</td>
<td>-0.207</td>
</tr>
<tr>
<td>Wage</td>
<td>-0.00975</td>
<td>-0.001</td>
</tr>
<tr>
<td>Male</td>
<td>-0.159</td>
<td>0.044</td>
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<tr>
<td>College and Year Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>120</td>
<td>79</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.321</td>
<td>0.396</td>
</tr>
</tbody>
</table>

NOTE: *** p < 0.01, ** p < 0.05, * p < 0.1.
References


The University of Texas at Tyler, Office of the President, “PATSS Proposal,” Tyler, Tex., 2013. UTT—See The University of Texas at Tyler.