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ul. Powstańców Wielkopolskich 16, 61-895 Poznań, Poland
phone +48 61 854 31 54, +48 61 854 31 55, fax +48 61 854 31 59
www.wydawnictwo-ue.pl, e-mail: wydawnictwo@ue.poznan.pl
postal address: al. Niepodległości 10, 61-875 Poznań, Poland

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Improving student outcomes through the well designed use of computer technology in university business classes[1]

Wendy Swenson Roth,[2] Deborah S. Butler[3]

Abstract: This study examines improving student learning outcomes through a structured approach to technology utilization in the design of the course. A process was developed to actively integrate laptops into two Business Intelligence classes where numerous software applications were introduced in order to build student skills with analysis. In addition the implications of a teaching lab with uniform hardware and software versus the variety that results when students bring their own laptops is also considered. Results showed students' evaluations of the process was positive and some significant improvements in skill development over the previous semester resulted. Insights and suggestions are explored.

Keywords: classroom technology, improved learning outcomes, course delivery and structuring, skill development.

JEL codes: M00, Y80, O30.

Introduction

Improving student learning outcomes in business education is a concern for learners, educators, the business community and policy makers. Gaweł [2014] recognized the relationship between business and academia as one of being mutual stakeholders. As a result of the relationship between these stakeholders, there have been important and marketable innovations such as the Triple Helix. This stakeholder relationship between business and academia was recognized as one where the process of educating students helped supply companies with prospective employees. In examining the relationship between these two stakeholders, Gaweł recognizes that collaboration can lead to both institutions satisfying important needs which could improve the economic devel-

[1] Article received 27 February 2016, accepted 16 May 2016.
[2] Robinson College of Business, Department of Managerial Sciences, 35 Broad Street, Suite 1020, Atlanta, GA 30303, corresponding author: wroth@gsu.edu.
[3] Georgia State University, Robinson College of Business, Department of Managerial Sciences, 35 Broad Street, Suite 1020, Atlanta, GA 30303.

opment of a region and the educational development of the society. These are important implications when considering various aspects of how to increase the value of what happens in an academic classroom.

One important consideration for increasing the value of what happens in an academic classroom is through the alignment of course goals and course design. Instructional design issues for improved student learning outcomes are complicated by a wide range of options and by often limited training on the part of the instructor in instructional design. McIver, Fitzsimmons, and Flanagan [2016] urge educators to become more mindful about when to apply specific design methods. They suggest mixing appropriate learning methods with desired outcomes when considering the best instructional course design. This is especially true when developing skills. For example, St. Peter and Butler [2011] found that the learning method of compressing delivery time for a course can have a positive impact on achieving learning outcomes focused on applying skills, but may have little effect when the focus is mostly conceptual learning.

Well-designed skills-based courses are important to the stakeholder relationship between business and academia. Elrod et al. [2015] refer to the necessary skills and competencies to enter the profession of accountancy. They point to Excel certification earned by a student during their academic program of study as a way to set the students apart from other competitors when they apply to the workforce. Standing apart from other applicants due to skill building increases career capital for those students. Avramenko [2012] recognized the value of skills-based learning when reporting on research concerning a well-designed business simulation. When the simulation design included a commitment to tutoring time to facilitate learning and engagement the students experienced a boost of confidence which was perceived by graduates as helping their employability. Prince et al. [2015] discussed increases in career capital for MBA students that occur when a well-designed transfer climate is created in the classroom. Such a climate may facilitate the transfer of MBA learning of knowledge and skills in the classroom back to the job context. Design considerations for such a transfer must take into account the motivation to learn, program utility and the reciprocal transfer of knowledge and skills between the two domains of university and work.

Skill building on the part of students is an important part of increasing career capital. For a skills based course to be delivered effectively it must be well designed. One meaningful design consideration in today's classroom is the incorporation of personal technology into the learning process. Although personal technology is well integrated into everyday life and the use of technology in almost all business settings is integral to doing the business of the business, there is still some confusion as to how to best integrate even the basic technology of a laptop into the design of a classroom learning experience so that it will increase career capital. A learning experience which incorporates the required use of technology necessitates that mindful consideration suggested by McIver, Fitzsimmons, and Flanagan [2016] be used in the design process.

This paper is divided into four sections. The first section explains the theoretical background. The second section outlines the methodology. The third section presents the results and discussion. The paper is closed by conclusions.

1. Theoretical background

Perhaps the first consideration for designing a course which requires the use of laptops is the issue of students being easily distracted by technology. Aagaard [2015] examines the process of being distracted by technology since students often use technologies for distractive purposes such as off-task activity and multi-tasking. Findings from interviews with Danish business students suggests such off-task activity is not always even a conscious choice. Aagaard's findings suggests technologies act as active agents so that when the classroom elicits boredom it might be because technological alternatives are constantly available and offer an attractive allure that can "pull" the student in.

Jeong, Shin, and Park [2015] conducted a qualitative study of Korean college students regarding the classroom use of notebook computers. Students reported perceiving the notebook computer in class as both an attractive and a risky learning tool. The risk for these students was the temptation to do outside work during class on the computer with a consequence of not being able to turn their attention away from the computer and back to the classroom. This study noted that students perceived the temptation to do outside work on the computer was caused not by the students themselves, but by outside factors. Students reported that they were less likely to do outside work on their laptop computers if they were engaged during the class in an interaction.

The need for students to have structured interaction when they bring their laptops to class seems significant. When and how to structure interaction with laptop computers is a challenge that is vexing to educators. It has been noted that despite the technical revolution university teaching practices have remained largely the same [Langan et al. 2016]. Obviously this must be addressed, given that students today are a digital generation who expect multiple forms of input [Lambert 2009]. Parker and Burnie [2009] report that only 21.74% of AACSB accredited business schools require students to bring laptops to specific classes. This highlights a vacuum that exists between the reality of electronic devices in the classroom and the practice of using them for improved learning. This vacuum is especially surprising considering that proficient and appropriate laptop skills will be required in most business students' careers.

Student and faculty perceptions of appropriate use of electronic devices in the classroom are significantly different [Baker, Lusk, and Neuhauser 2012]. Kay and Lauricella [2011] describe three pedagogical reactions from instructors in higher education to the laptop culture: *reject, ignore or accept*. Most of today's students are so connected to their devices that rejecting laptops opens the door to losing all relevancy in their eyes. Ignoring is not a good strategy. Lawson and Henderson [2015] reason that students will be happy with the absence of a policy about the use of classroom technology but it assumes that students will take responsibility for the risks associated with using technology in the classroom. Perhaps one alternative is using mindful design to incorporate personal technology into the classroom. Whilst being sensitive to the risks of classroom technology, educators may improve learning outcomes.

When students do attempt to multi-task and perform off-task activities, numerous studies indicate that the impact on learning is unfavorable [Wood et al. 2012]; [Gaudreau, Miranda, and Gareau 2014]. Martin [2011] found a slightly negative result when comparing two business statistics' classes; one taught in a traditional class and the other taught in a computer lab. Fried [2008] found unstructured in-class laptop use not only negatively impacted students' learning but also had negative implications for fellow students. Sana, Weston, and Cepeda [2013] found similar results, commenting at the end of the research on the need to focus on ways that on-task activities can be maximized and distractions reduced. A laptop initiative studied by Wurst, Smarkola, and Gaffney [2008] did not significantly improve outcomes in a business honors program. Concluding remarks expressed the need for effective computer-classroom integration training for the faculty. These results indicate that appropriate laptop use is more complex than just requesting students to bring their devices to class. Design considerations are essential in order to maximize on laptop use for positive student learning outcomes.

In an effort to address this issue Lindroth and Bergquist [2010] analyzed students' uses of laptops as different types of involvement, arguing that the devices are neither good nor bad but rather outcomes are determined by their usage and how it is structured. Demb, Erickson, and Hawkins-Wilding [2004] studied student perceptions of the value of laptops. Findings included that the major factor impacting student perception of the value of laptops to academic success was their perception of the quality of faculty utilization of the technology for teaching. The issue of structured use of the technology by the instructor was also associated with student perception of the laptop as a valuable tool for academic success in the Jeong, Shi, and Park findings [2015].

Much of the research to quantify off task behavior during class is based on student self-reporting. In an effort to collect independent data, Sovern [2013] and Morse [2012] observed law students manually timing how often they went off task. Unexpected results highlight the need for more research in this area. Both studies found that the academic level of the student impacted the amount of off-task behavior. Upper year students were significantly more likely to be distracted than first year students. Professor Novak Morse found that students with higher LSAT scores tended to exhibit more off-task behavior and, unlike other research, found no correlation between increased off-task behavior and final course scores. Both researchers recognized the need for an improved teaching method to incorporate laptops in the classroom. Morse identified conditions that promote off-task behavior and strategies to help re-direct student attention. Sovern [2013] finished with a plea for more research into what increases student attention, thereby enhancing learning. Other research in the law school environment [Murray 2011] found laptops to be less of a problem than assumed and encouraged the faculty to provide students with guidance on ways to maximize learning and minimize potential negative impacts when laptops are present in the classroom.

Research providing guidance on successful laptop integration in the classroom includes Skolnik and Puzo's [2008] finding that laptops enhanced learning, especially in spread sheet skills. Effectiveness, however, was impacted by what was taught and how it was delivered. Research into the appropriate and effective uses of laptops in the classroom includes the development of a metric to assess the merits of classroom laptop usage by Kay and Lauricella [2010]. The metric is designed to have students report the amount of class time spent on academic and non-academic activities. When implemented in the classroom it has provided instructors with the information necessary to improve classroom laptop usage. Kay and Lauricella [2011] studied laptop use in higher education by comparing the impact of passive integration in lecture (defined as unstructured) and active integration into lecture (structured). The results found the use of structured activities decreased non-productive laptop behaviors.

The unstructured/structured nature of Kay and Lauricella's [2011] research is similar to the concept of active learning. Active learning techniques can take many forms such as Weldy and Turnipseed's [2010] use of a management project to enhance learning. Much research into various active learning methods has been performed. Bonwell and Eison [1991] provide a thorough analysis of active learning at the higher education level, including a summary of empirical research on the topic.

Though many active learning definitions exist this research uses the definition from Prince [2004], "any instructional method introduced in the classroom that engages students requiring them to do meaningful classroom activities." This is in contrast to the traditional lecture where students passively receive information from the instructor. Core elements for active learning as defined by Prince [2004] are:

1. Introducing student activity into the traditional lecture,
2. Promoting student engagement.

A goal of active learning is to improve a student's engagement with the material therefore decreasing the likelihood of a student becoming distracted. Laptops in the classroom increase the avenues available for students to become distracted. Designing a course which keeps students engaged and on-task therefore becomes critical to encourage successful outcomes.

The goal of this research is to add understanding to a mindful application of specific design methods when addressing laptop integration into the classroom. This study looks at how active learning elements impact student learning and student satisfaction, and specifically, when various software applications are introduced. In addition the study considers how the source and variety of laptops as well as the different levels of students (undergraduate versus graduate) impact these outcomes.

2. Methodology

Business students need to master various software applications, such as Excel, to develop a regression model or Tableau for data visualization. These skills are important for students in order to build career capita and for the relationship between business and academia [Gaweł 2014; Elrod et al. 2015]. The learning process has often consisted of demonstrating the application and students taking notes. Students then go home to complete homework using the tool that had been demonstrated in class; not unlike learning to drive by watching someone drive. This was often the method I used especially before laptops became commonplace. This design met with mixed success, some students easily mastered the applications, but many reported being frustrated when they later tried to replicate what I had demonstrated. Level and skill of the individual student, difficulty of and familiarity with the application are factors that impact success.

It seems obvious that integrating laptops into the class environment would increase a student's opportunities for mastery. This is especially true when teaching a quantitative course such as Business Intelligence. Over the course of the semester four software applications are introduced. Each one is used to address a component of the Business Intelligence architecture. The overall goal is to familiarize students with each application and to teach them basic functionality.

Teaching an undergraduate Business Intelligence class in the newly created Teaching Innovations Lab (TIL), which contains interactive tablet based com-

Table 1. Comparision of class environment

Laptops source	Class 1: Teaching Innovation Lab: (TIL) Uniform technology	Class 2: Student provided laptops: (SPL) Variable Technology
Level of student	Undergraduate	Masters level
Number of students	10	17
Number of periods per week and time of each session	Twice per week 2.5 hours	Once per week 5 hours
Time of day	Late night	Saturday morning

puters for each student, became an ideal situation to explore integrating laptops into a class with the goal of improving student skills. To provide further experience in the benefits and challenges of using laptops in class, students in a graduate Business Intelligence class were requested to bring a laptop to class or work with a fellow student with a laptop during the class (Table 1). This will be referred to as the Student Provided Laptops (SPL) environment. The variability in these two environments is described in Table 1.

2.1. Active learning and coaching

Once the decision was made to integrate laptop use into the course concerns existed about the distractions from these readily available devices. To address this the following design of actively integrating the use of the laptops into the classroom was followed (Table 2). This approach was chosen to address the issue of student distraction and also provide an environment more related to coaching.

Table 2. Example of active learning process

	Example: Building Visualizations with Tableau
Prepare, show, follow along	Prepare: 1. Provide instructions for loading Tableau to laptop 2. Provide two data sets to download Show, follow along: 3. Overview application 4. Demonstrate: creating various charts and dashboard
Exercise, ask questions	Assignments to complete in class: Using Tableau answer the following questions: 1. Which product type (Chai/English Breakfast/Green/Herbal) yields the **maximum profit** in each market size(major/small)? See Appendix A for complete example
Perform activities individually, homework	Homework: Using Tableau answer the following questions: 1. Which product category (Cribs/diapers/toys/clothes) yielded the **maximum sales** in which year (2010/2012/2013/2014)? See Appendix A for complete example
Demonstrate mastery, exams	Exam Question: Two data sets have been loaded to Exam 2 folder on D2L. (DogstatsUS and HistoricalPromDressPurchases) Please pick **one** file. Explore the data set using Tableau, define tasks and present your results. The goal is to determine something interesting or unique from the data set and then **present it in a professional manner.** Your results should be in the form of a report and should include a write up discussing the data set and your analysis of the results. It should also include charts that you have created in Tableau. At least one map is required in your Tableau charts

Prepare, show, follow along. Students were notified before class when a new application was to be introduced and instructions were provided on how to load it to their laptops. Data sets to be used in class were also provided. When introducing an application the computer screen was projected on the front board and students were encouraged to follow along as basic operations were introduced.

Exercise, ask questions. Assignments were then provided to complete during class time. These assignments were similar to those just demonstrated. This allowed time to walk around class, check progress and address individual questions. Thus providing a chance for one-on-one coaching interactions with students.

Perform activities individually, homework. Homework, similar to those exercises given in class, was assigned.

Demonstrate mastery, exams. Examination problems were given requiring students to demonstrate their abilities to use the software application in a business setting. Often these were take home exams but could be modified to be completed in class.

Table 2 presents an example of this process. This is based on an exercise provided by Tableau teaching resources. See Appendix A for supporting documents.

2.2. Outcome measures

The process presented in the previous section was used for all software applications introduced during the semester. Complexity and familiarity with the software impacted student mastery of the application (Table 3). To help analyze results a summary of the semester's software application's complexity on three factors is provided in Table 3.

Table 3. Software comparison

Software	Measure of difficulty		
	Intuitiveness of interface	Student familiarity with software	Understanding of function of application
Excel	easy	yes	yes
Tableau	easy	no	yes
Access	less intuitive	some similarity to Excel	no
Weka	not intuitive	no	no

Both classes covered similar material, though more in depth at the graduate level. Certain assignments were consistent enough to allow for comparison. Surveys were given at the end of the semester to each class to receive feedback on a student's perceived increased skills and confidence with the various software applications. Copies of the surveys used are available from the authors upon request

3. Results and discussion

Insights from this research focus on items particularly important as students prepare to enter the workforce. These include the goal of increasing career capital through improving student skills. Improved student's awareness of their ability to stay on task is also addressed. This is viewed through the lens of developing appropriate laptop etiquette for future business meetings. In addition, the impact on these outcomes due to the use of uniform university-provided technology versus variable student-provided technology was considered.

3.1. Impact on student perception of benefits and confidence

When considering student feedback on the use of laptops in the classroom, providing the chance to work with the software was viewed as positive regardless of whether a computer was provided or not. When asked how using the computers impacted their understanding of material presented, both undergraduates and graduate students overwhelming said it was helpful. At the end of the semester, some comments from students about the strong points of the course included:

- Learned different tools in Excel, Access, Tableau, and other programs
- Exposure to different software and online applications (Tableau, data mining programs, etc.).

Students reported improved confidence in their abilities to use these software tools in the future (Figure 1); this confidence is important as it is tied to a greater sense of career capital. As Figure 1 illustrates, the impact was influenced by the skill of the student (graduate versus undergraduate), difficulty of software application and source of laptop. More familiar applications or those with an easier interface (as described in Table 3), resulted in higher levels of student confidence.

The confidence levels students expressed for future use of Weka, though lower than the other applications, were very encouraging. Weka is a free software tool containing a collection of visualization and data analysis tools. None of the students were familiar with Weka or the data mining activities performed with the software. After working on Weka for less than one class period, students were able to complete assignments and expressed confidence in their abilities to use the tool in the future.

Though the sample sizes are limited, comparisons of three graded activities from the undergraduate class to the results from the previous semester when

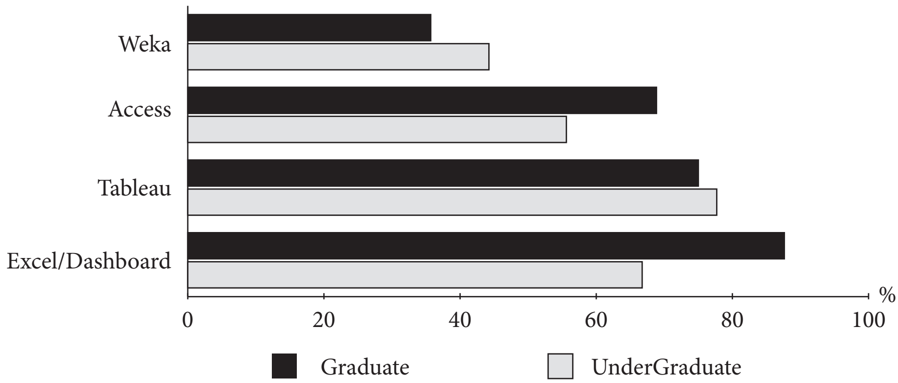

Figure 1. Percentage of students much more confident in using a specific software tool in the future, separated by undergraduate and graduate students

the instructor taught the same course, without incorporating laptop usage, provided some evidence of improved outcomes (Table 4). Three activities were chosen because they were the same or similar enough to allow for comparison.

Table 4. Null hypotheses: means equal or has decreased, alternative hypotheses: mean has increased. Assuming unequal variances

t-Test:	Comparing	Mean scores versus	Previous semester
	Homework: Access	Exam: Access	Exam: Dashboard* Sp14:Excel Su14: Tableau
P(T< = t) one-tail	0.003584	0.064082	0.064406

Two of the graded events demonstrated the ability to use Microsoft Access. From previous experience, this is one of the applications that students often struggled to learn. The concept of a data base and this specific application were unfamiliar to most students making the learning process more difficult. The third activity involved creating a dashboard. The assignments were very similar. The difference was that the spring students used Excel and the summer students were required to use Tableau. This made the spring assignment slightly more difficult since students were unfamiliar with Tableau at the beginning of the semester.

When comparing the average scores a t test was administered to determine if the mean for the summer session was significantly greater than the spring semester. Mean scores for the summer were significantly greater at a 95% confidence level for the Access homework assignment. Both exam activities improved at a 90% confidence level. A previous class to compare the graduate class results was unavailable. See Appendix B.

Staying on Task: Even with active learning activities encouraging students to stay on-task, the possibility of distraction was a concern. The TIL provided a possible solution to this issue with a screen showing what students were logged on to. In reality this was not particularly helpful. It was too distracting to check what students were doing during lecturing. In addition an effective action plan to use this information was required. Pointing out students' wanderings would create a distraction for the entire class and disrupt the flow of the lecture.

In order to gauge the magnitude of this issue, at the end of the semester the students were surveyed, asking, "How often were you distracted and spent time on the laptop doing non-class related items (such as on the internet, etc.) while material was begin covered in class?" (Table 5). The results highlight that being distracted or multitasking was a common occurrence and happened even in classes where students knew you may observe their laptop activities. The results showed that the graduate students were able to remain on-task slightly more than the undergraduate students.

Table 5. Student reported amount of time distracted due to laptop (in %)

	Never	Occasionally
Undergraduate	33.33	66.67
Graduate	37.50	62.50

3.2. Impact of uniform versus variable technology

This research showed that the source of the laptop was much less important than the software that was loaded on it. Whether university or student provided laptops issues existed that needed to be addressed to prevent them from impacting the learning process.

Hardware: As seen in previous research students in both classes reported access to a laptop was less of an issue than the hassle factor of actually bringing it to class. 82% students responded that bringing a laptop was not a problem. The remaining students said it was inconvenient but would bring one. These results were similar to additional survey results from two fall 2014 undergraduate Business Analysis classes. Of the 85 students participating in that survey only one lacked access to a mobile device. In addition, 69% reported they would be able to bring a laptop to class. Though not 100% it was a significant proportion of the class.

The percentage of students who referenced inconvenience was significantly larger than those who lacked access. Twenty-nine percent of the above mentioned business students said it would be inconvenient to bring a laptop to class and this inconvenience might impact on whether they chose to bring the laptop to class. Based on these results, informing students before class of planned laptop usage was an appreciated courtesy.

An unanticipated hardware issue resulting when students brought their own laptops was the lack of electrical outlets in most classrooms. Unfortunately this was not an easily addressed issue. Due to the length of these classes, 2.5 to 5 hours long, outlets were a highly demanded resource.

Software: Classes held in the teaching lab avoided the issues of students bringing laptops, forgetting to load the software, various version of software, windows versus mac, etc.. This arrangement, however, wasn't the utopia hoped for. Issues that were avoided in the classroom often showed up when students went home to complete their homework. Forty percent of TIL students said the software used outside the classroom was a different version than the one used in class. Of these 25% said it impacted their homework. Basically the TIL was easier when working in class, but harder when it came time for homework.

When asked how helpful the use of computers in the classroom was when it came time to work on homework, for Excel, Access and Tableau 90% of TIL students felt it was helpful compared to 98% for the Student Provided Laptops (SPL).

An issue in the SPL classroom was the variety of software versions. This required class time to address when menus were slightly different. Results also showed that a higher number of students in the SPL class reported often or occasionally having difficulty following along when compared to the TIL (Figure 2). This was especially significant since these are the graduate students who would be expected to have fewer issues following along when compared to undergraduate students, thereby reflecting the benefit of the uniformity in the TIL.

The various versions of Excel that must be dealt with in a SPL environment presented a small inconvenience compared to the bigger issue of Windows versus Mac. From the application side, Windows was the preferred software. However when considering what students chose to purchase, the tide seems to be turning. In a survey of two sections of undergraduate Business Analysis students in fall of 2014, 42% reported owning a Mac. How to get the Analysis

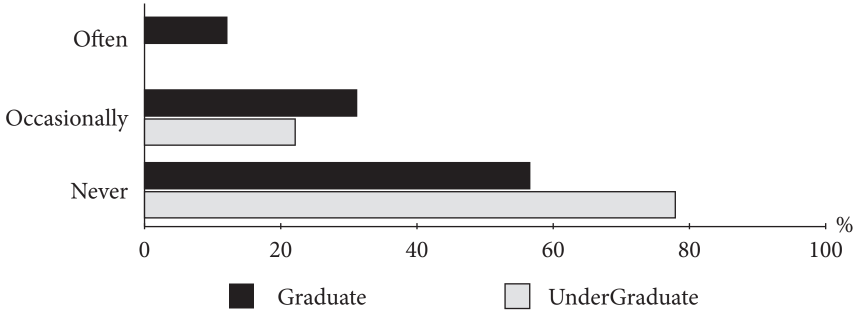

Figure 2. Percentage of students reporting how often had difficulty following along in class, separated by undergraduate(TIL) and graduate students (SPL)

Tool pack or install a windows emulator were both questions raised by students. Being able to at least point students to information sources was very helpful. In addition, when students had their laptops with them in class, often they were able to help each other resolve these and other questions.

Conclusions

Laptops and the software that runs on them are often integral as to how students complete assignments. Skills developed in the use of various software applications will impact performance in their future careers. Therefore well designed, active integration of laptops into the classroom that results in improved learning is critical for academia and the business community.

Students perceived value in their newly developed software skills and were confident that they would be able to apply them in the future. Insights into the impact of uniform versus variable laptop hardware and software are provided with the goal of providing guidance for instructors who are ready to begin actively designing a course which integrates laptops into their classroom.

Since the original study was conducted, these techniques continue to be used in graduate and undergraduate Business Intelligence classes. Taking a longitudinal view of the assignments given, actively integrating laptops in to the classroom has allowed the level of difficulty to increase over time, without any decrease in results. This is due to the increased confidence that results from working together with students, explaining and resolving issues in a more productive and less frustrating manner.

More research is needed to continue improving the best design integration of laptops in the classroom. This includes developing additional assignments to take advantage of the devices and exploring ways to measure the outcomes on student learning. It is equally important to explore ways to encourage students to develop appropriate etiquette when working with devices in the classroom.

Appendix A: Support documents for active learning exercises

From Tableau documents
IN Class: Tea Store Sales
Using Tableau answer the following questions:

1. Which product type (Chai/ English Breakfast/ Green / Herbal) yields the **maximum profit** in each market size(major/small)?

   Hint: drag and drop product type and market size from dimensions to columns and drag and drop profit from the fact table (measures) to rows. **Go to Label > Show Mark Labels.**

2. Which product type(Chai/ English Breakfast/ Green / Herbal) yields **maximum sales** in each market (east/ west/south/central)?
   Etc.

   Homework: Baby Store Sales
   Using Tableau answer the following questions:

1. Which product category (Cribs/diapers/toys/clothes) yielded the **maximum sales** in which year (2010/2012/2013/2014)?
   Etc.
2. Create a Dashboard using the data set. It should contain at least 3 panels and they should be linked together.

Appendix B. Comparison of graded activities

Homework Access: t-Test: Two-Sample Assuming Unequal Variances		
	4020 spring 14	**4020 summer 14**
Mean	8.8823529	9.9166667
Variance	1.8602941	0.0833333
Observations	17	12
Hypothesized Mean Difference	0	
Df	18	
t Stat	–3.031972	
P(T< = t) one-tail	0.0035844	
t Critical one-tail	1.7340636	
P(T< = t) two-tail	0.0071687	
t Critical two-tail	2.100922	

Exam 1:Access: t-Test: Two-Sample Assuming Unequal Variances		
	4020 spring 14	**4020 summer 14**
Mean	86.318182	91.083333
Variance	88.132035	62.265152
Observations	22	12
Hypothesized Mean Difference	0	
Df	26	
t Stat	–1.571471	
P(T< = t) one-tail	0.0640823	
t Critical one-tail	1.7056179	
P(T< = t) two-tail	0.1281647	
t Critical two-tail	2.0555294	
Exam 2: Dashboard: t-test: Two-Sample Assuming Unequal Variances		
	4020 spring 14	**4020 summer 14**
Mean	82.173913	90.166667
Variance	109.42292	241.78788
Observations	23	12

Hypothesized Mean Difference	0	
Df	16	
t Stat	−1.601548	
P(T< = t) one-tail	0.064406	
t Critical one-tail	1.7458837	
P(T<=t) two-tail	0.128812	
t Critical two-tail	2.1199053	

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