Enhancing Student Performance through Web-Based Interactive Learning Systems: A Case Study of MyEconLab

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Many Economics textbooks are nowadays bundled with web-based interactive learning systems that are specifically created to enhance student understanding of the material and allow for the possibility of completing numerous practice questions. As we all know, practice is essential component of student learning since it helps students develop their analytical thinking and ability to solve problems—assets that are extremely valuable in today's world. The goal of this paper is to investigate students' perceptions regarding the use of MyEconLab, as well as to study the impact of this web-based interactive learning platform on student learning.

Key words: MyEconLab, interactive learning systems, enhancing student performance, Business education

1. Introduction

Many textbooks, especially in Economics, Microeconomics, Macroeconomics, International Economics, Accounting, and Statistics, nowadays can be bundled with web-based interactive learning systems at affordable prices. Sometimes they even come free of charge with the purchase of a new textbook. Some of the most popular web-based learning platforms are MyEconLab, MyStatLab, MyAccountingLab, Aplia, and Connect Economics. These systems have been specifically created to improve student understanding in the subject matter and

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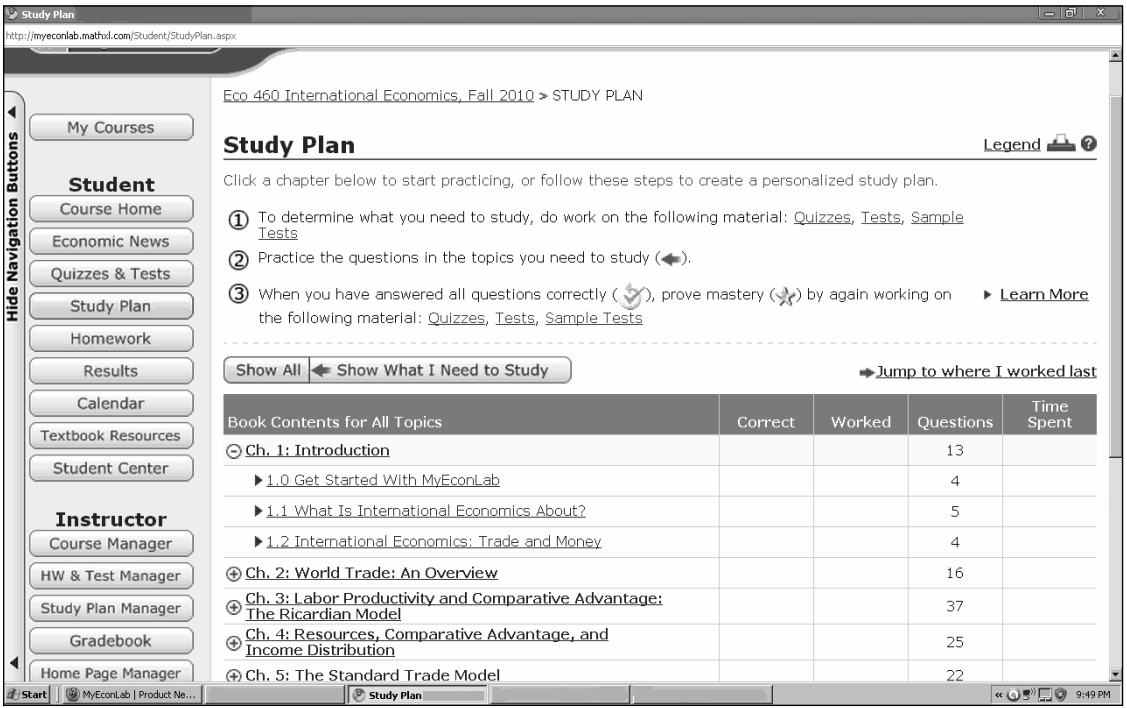
allow for the possibility of completing many practice questions. Practice is essential component of student learning and understanding. It can help students develop their analytical thinking, as well as their ability to solve problems. These two traits are extremely valuable in today's world.

Web-based learning systems are gaining popularity among instructors in the United States. Aplia reports that more than 1,300 institutions and 1,000,000 students have used their system so far and many instructors state that "their students are experiencing clear benefits, including increased success for students and a reinvigorated classroom environment." According to Michelle Speckler (2008), "since 2007 more than 50,000 students at more than 200 colleges and universities worldwide have used MyAccountingLab. More than 500,000 MyAccountingLab questions have been answered and graded as part of accounting homework assignments or tests." MyEconLab has been used by more than 70,000 students at more than 600 institutions worldwide from 2002 to 2006.[1]

Web-based interactive learning systems are powerful tools that help instructors use their in-class and out-of-class time more efficiently, but more importantly, they are claimed to enhance student learning. These systems allow for automatic grading of homework assignments, quizzes, and tests. They are textbook-specific. Economics (Principles of Microeconomics, International Economics, and Principles of Macroeconomics) and Business Statistics are subjects that are not easily grasped by students and need a lot of practice, as well as real world examples that reflect the material covered in class. MyEconLab (www.myeconlab.com) has features that have the potential to substantially improve student learning—personalized study plan, "unlimited" practice, learning resources, and sample tests. For each chapter of the textbook there are

[1] These figures are based on a study conducted by Michelle Speckler, the president of Speckler Creative, an independent marketing/communications company located in Livingston, Montana. Her report was written in the summer of 2006 so most likely these numbers are much higher right now.

FIGURE 1. MyEconLab's Interface.



a large number of practice questions and two practice tests that students can do on their own. They can test their knowledge of the material by completing these practice problems. The system provides an immediate feedback and an explanation of how a particular question should be answered correctly. Many questions ask students to work with graphs (interpreting, manipulating, and drawing graphs). Instructors have the ability to customize the practice tests or can use pre-built tests. In addition, based on individual practice test results, MyEconLab generates a personalized study plan, which gives a summary of the topics a student needs to study in order to advance his or her understanding of the material.

Furthermore, the system has tutorial instructions and weekly news updates with links to related web sites. Instructors can use MyEconLab also as a course management system (similar to Blackboard, Angel, WebCT). It has different administrative modules—course manager, homework and test manager, study plan manager, gradebook, and announcement manager (see figure 1 above).

One of the goals of this study is to survey students on their perceptions regarding the use of MyEconLab. The second, and the more important goal, is to evaluate the extent to which the web-based learning platform influences student performance. MyEconLab is a relatively new product and there is limited research regarding its value, effectiveness, and impact on student learning.

2. LITERATURE REVIEW

Web-based learning systems offer students with an interactive tool for completing homework assignments by providing them with the choice to repeatedly answer questions or problems (if allowed by the instructor) and giving students an instant feedback about their understanding of the concept material. A number of studies show that students who devote more time to studying and exert more effort throughout the semester are much more likely to perform better on exams and receive higher grades in a class (see for instance Eskew & Faley, 1988).

The successful completion of a homework assignment regularly requires significant effort by students and works as a motivation tool for studying and learning (Rayburn & Rayburn, 1999; Farrelly & Hudson, 1985). Lefcort and Eiger (2003) found that both preparatory assignments (given prior to the discussion of the material) and practice assignments (given after the material was covered in class) improved student performance in an introductory biology class. Similar findings are reported by Arasasingham, Martorell, and McIntire (2011) regarding online homework. The authors claim that online assignments substantially influenced exam performance based on a six-year study with 3,806 students enrolled in an introductory science course. Cheng, Thacker, Cardenas, and Crouch (2004) also provide evidence that online graded homework improved student understanding of physics concepts. The gain was significantly greater for classes that were taught with interactive engagement methods.

On the other hand, Weems (1998) did not find significant evidence for the benefits of homework assignments in an intermediate algebra class based on the class performance of treatment and control groups. However, the number of A grades in the class with assigned homework was much larger than in the class without required homework, suggesting that these assignments improved the performance of the better or above-average students. Bonham, Beichner, and Deardorff (2001) compared student performance of two large sections of an introductory calculus-based physics course and two sections of an algebra-based course. Each course was taught by the same instructor but the employed homework method was different—one section had on online homework whereas the other one had to turn in their homework on paper, which was graded thoroughly by a teaching assistant. The results of this study indicate that even though the mean performance of the students in the two classes with assigned online homework were higher than the mean grades of the two classes with traditional homework assignments, the difference in student performance was not statistically significant.

Research has shown that students have positive perceptions regarding online homework (see for example Johnston, 2004; Kortemeyer et al., 2005).

According to Richards-Babb, Drelick, Henry, and Robertson-Honecker (2011)'s study 83.5% of the students perceived the online assignments as worth the effort, 75.6% indicated that the completion of the homework encouraged more consistent study habits, and 85.7% of the surveyed students would recommend the use of online homework in the general chemistry course they were enrolled in. Similarly, the administration of online homework in an undergraduate finance class and an MBA class helped students to understand the subject matter and increased the time they spent in studying and preparing for the class. Students also indicated that they preferred online assignments to traditional homework assignments possibly due to the immediate feedback received in the former type of assessment (see Smolira, 2008). This is consistent with Lindquist and Olson (2007)'s findings that student satisfaction with final grades and learning outcomes increase due the provided feedback.

Peng (2009) studied the role of cognitive need, computer efficacy, and perception of students in completing online accounting assignments. The effort exerted in working on homework problems is found to depend on students' individual characteristics and their perception of the web-based learning system. In particular, the results of this study suggest that the less motivated students, as measured by their need for cognition, because of the online homework system put more effort in completing homework. In contrast, students with high motivation might not be as greatly affected by the online homework system because they were *a priori* motivated to perform well in this class. In addition, students who were confident and competent in using computers were more likely to exert more effort in making use of the system. For those students who had poor computer abilities the online homework system was used more only if the system was perceived to be interactive. Individual abilities and differences among students are crucial determinants of the success of educational information systems (see for example Seyal, Rahman, Noah, & Rahim, 2002).

The research of the benefits of online homework has provided mixed results. The majority of the studies find positive impact on student

performance in various science-based classes as mentioned above. Student attitudes towards online homework systems have also been predominantly positive. However, there are not many studies that investigate these two research questions in the field of business education, and more specifically regarding the benefits of MyEconLab.

Case studies at several colleges and universities across the United States along with surveys of students and instructors have provided some evidence that the use of MyEconLab helped students to improve their grades. Richard Schiming (Minnesota State University, Mancato) used MyEconLab in his principles of macroeconomics classes for four semesters, fall 2006 - spring 2008, to investigate whether there is a correlation of MyEconLab usage to final course grade. Schiming (2008) has found that the more a student uses MyEconLab measured by the average time spent on MyEconLab homework and quizzes, average times spent on optional sample exams, or average time spent on MyEconLab activities, the higher will be their final grade. The reported numbers show a positive relationship between average time and final grades. For instance, students with an A spent 5 hours and 49 minutes on average doing homework and quizzes, 5 hours and 4 minutes on average on optional sample exams, or 10 hours and 53 minutes on average on MyEconLab activities whereas students whose final grades were B spent on average 3 hours and 58 minutes on homework and quizzes, 2 hours and 11 minutes on optional sample exams, and 6 hours and 9 minutes in total. Another finding is that students whose scores dropped from one exam to the next by 10 or more points spent 66% less time on MyEconLab activities in between the exams.

Similar outcomes are reported in Ryan (2008). Professor Ryan used MyEconLab for 2 semesters in his principles of microeconomics course (spring 2007—fall 2007) at the Western Michigan University. He found that "of those students whose score decreased one letter grade or more from exam 1 to exam 2, 64 percent spent less time on the program before exam 2 than they did before exam 1." Dole (2008) also confirmed the direct association between time spent on MyEconlab and earned grades in both traditional and online courses at

Jacksonville University. These three case studies did not compute the actual correlation coefficients—the conclusions were based on summary statistics and comparisons.

Bajrami (2008) provided more quantitative results with regards to the actual correlation. She tested the hypothesis for a positive correlation between the number of exercises completed using MyEconLab and final grades based on a cross tabulation. The relationship was positive and statistically significant as indicated by the gamma value and the approximate t-statistic based on 37 valid cases. Of the 70 students that were surveyed 85% agreed that MyEconLab was either useful or very useful to their effective learning of microeconomics or macroeconomics (spring and summer 2008). Brauer (2008) gradually increased the usage of MyEconLab in his introductory microeconomics course over time. In the fall of 2006 this course was transformed into a self-study by replacing lectures with MyEconLab assignments. Brauer (2008) provides some evidence that the decrease in attendance had no negative impact on average quiz and test scores.

Nguyen and Trimarchi (2010) demonstrated that MyEconLab and Aplia could help students improve their performance. Their results show that the use of the two systems increased class grade averages by about 2% when comparing classes with optional usage of MyEconLab or Aplia to classes taught by the same instructor using the same textbook and no technology.

Michelle Speckler (2006) summarized the results from a nationwide survey of students that used MyEconLab. The survey was conducted in the fall of 2005 by Contemporary Solutions. Some of the main findings of this survey are as follows: 70.4% of the students indicated that they used the Study Plan feature of MyEconLab (n = 325), 90% of the surveyed students felt that the Study Plan questions helped them prepare for the tests (n = 227), and 83.9% of Texas A&M students answered that they would recommend MyEconLab to a friend (n = 33). A number of instructors were also surveyed and they expressed their satisfaction with the system. For example, Diana Fortier of Waubonsee Community College said that “MyEconLab keeps my students on track..... Chapter quizzes

offset student procrastination by ensuring they keep on task. If a student is having a problem, MyEconLab indicates exactly what that student needs to study" (Speckler, 2006, p. 8).

The results of the these studies are encouraging and suggest that MyEconLab is a good instructional tool that could possibly improve student learning and help students receive better grades. The goal of this paper is to shed more light in this understudied area. In particular, I use data from MyEconLab, the course grade book, and a student survey which was administered to students enrolled in an international economics class in the fall of 2010 at a four-year college located in the Eastern part of the United States. I study the correlation between the time spent on different MyEconLab tasks and final course grade. I also provide a report about the perceptions of students regarding the use of MyEconLab.

3. Methodology

The benefits of using MyEconLab can be summarized as follows: the immediate feedback that students receive when completing their homework assignments, the ability to see similar examples (using "Similar exercise" option), as well as the numerous practice questions they can do on their own in order to master the different topics covered in class, which can ultimately help them achieve a higher grade in the class.

3.1. Course Design and Assessment

International Economics is an upper level elective course offered to undergraduate students at a private college/university in Western New York. Most of the students that take this course are Business majors and are either juniors or seniors. Classes meet two days a week for 75 minutes per session. This is a standard course—taught on campus for a whole semester. Grading in the course is based upon four group assignments, nine online homework assignments completed on MyEconLab, one project, two midterm exams, and a comprehensive final exam.

Online homework assignments compromise about 13% of a student's final grade.

3.2. Study Participants and MyEconLab Implementation

The participants in this study were the students enrolled in ECO 460: International Economics in the fall of 2010. Introduction to MyEconLab and a brief explanation of the technology's features were provided in the beginning of the semester. Students were first given a practice assignment (not for grade) to familiarize themselves with the system before they started to complete the actual homework assignments.

Individual homework assignments were designed to promote learning by doing. An assignment was given for each chapter covered in class. Students had to complete these assignments by logging into their MyEconLab accounts. The lowest two scores on the homework assignments were dropped and not counted towards the final grade. Students usually had about a week to complete the assignments and for the majority of the exercises they were allowed two attempts per question. Some of the problems were multiple-choice questions testing general knowledge of the subject matter but many of them were algorithmic and involved computations or graphing. If a student does not answer a question correctly, they can attempt answering a similar question and the points they get are based on their best answer. Students were strongly encouraged to use the Study Plan and complete the two tests available for each chapter. Sometimes the exercises on the graded homework assignments came directly from the Study Plan questions' pool.

Toward the end of the semester, students were asked to voluntarily participate in an online survey to evaluate the usefulness of MyEconLab as a supplemental instructional tool. They were given a consent form to complete. The goals and the nature of the research was explained briefly. The survey contained various questions aimed at analyzing students' perceptions about the usage of MyEconLab. The majority of these questions used a Likert-type scale but there were also some open-ended and general demographic questions.

4. Results

4.1. Survey Results

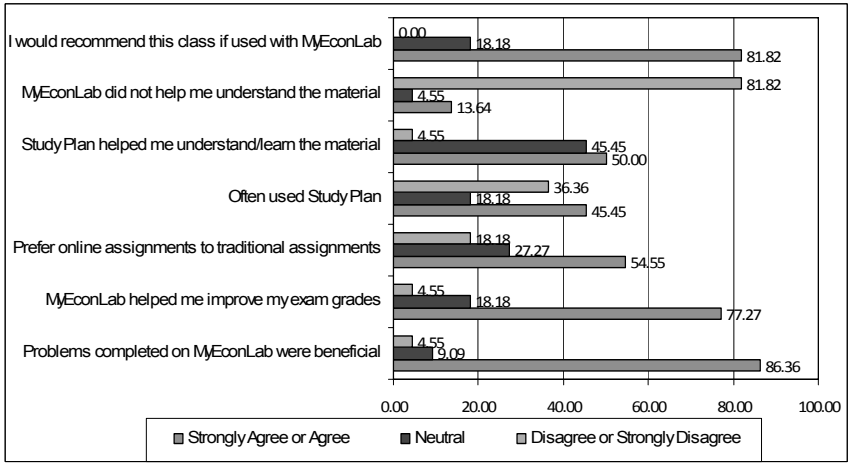
Twenty-two out of the twenty-five students enrolled in this course participated in the survey. The mean age at their last birthday was 20.6, the median was 21, and the ages ranged between 19 and 23 years. Seventeen students (73.9% of the class) indicated that they were residents of the state of New York, two were from Ohio, and four were international students. In terms of gender, slightly more students were male (12 male versus 10 female). A summary of the responses to some of the demographic questions are provided in Table 1.

Table 1. Demographic Characteristics of the Participants.

	Number	Percentage
Gender		
Male	12	54.5
Female	10	45.5
Live on Campus		
Yes	10	45.5
No	12	54.5
Class Standing		
Sophomore	1	4.5
Junior	10	45.5
Senior	11	50.0
Residence		
NY	16	72.7
OH	2	9.1
International Student	4	18.2
Major		
International Business and/or International Relations	12	54.5
Economics and/or Finance	7	31.8
Accounting and Finance	2	9.1
Entrepreneurship	1	4.5

Of those students who completed the MyEconLab survey, 77.27% thought that this technology helped them improve their exam grades, 86.36% said that the MyEconLab practice problems they had done as part of their homework assignments were beneficial and provided a good practice for the exams (see figure 2 for details). About 55% of the participants indicated that they would prefer to have online homework assignments to traditional assignments submitted on paper to the instructor. Around 27% responded that they would not mind having either type of assignments (online or traditional). Less than 50% of the students answered that they used the Study Plan often (45.45%) and 50% of them thought that this feature of MyEconLab was helpful in understanding and learning the material. Regretfully, not too many students took advantage of the Study Plan so they were unable to see the gains that this feature can provide. In addition, usually the best students or those that struggle with the material tend to do more practice questions so probably this is the reason for the received responses to this survey question.

FIGURE 2. Summary of Student Perceptions Regarding MyEconLab Use.



Note. The data is in percentages.

Approximately 82% of the students disagreed or strongly disagreed with the statement "MyEconLab as a whole did not help me to understand the material". This question was asked in a negative form to check whether students pay attention to the survey questions and think about their response before submitting their answers. Also 81.82% of the participants said that they would recommend this class to a friend if the professor requires the use of MyEconLab as a supplemental study tool.

The majority of the survey participants were satisfied with the use of MyEconLab. In particular, 13 students responded that overall they were satisfied, 6 said that they were very satisfied, 1 was neither satisfied nor dissatisfied, and just two of the students reported that they were dissatisfied with this technology. Overall, 86.4% of the students were satisfied or very satisfied with the use of MyEconLab.

4.2. Correlation Analysis

To analyze the relationship between the use of MyEconLab and students' performance, I first provide a summary table showing the average time spent on MyEconLab completing various assignments for each grade range. Then, I compute the Pearson correlation coefficient for two groups of students: students whose final grades were either A or B and for all grade ranges. Finally, I test for the significance of the results.

Table 2 provides the mean time students spent completing homework assignments on MyEconLab, working on practice questions as part of the Study Plan, doing online tests, as well as the total time spent on

Table 2. Mean Time Students Spent on Different MyEconLab Tasks by Grade.

Grade	Homework	Study Plan	Tests	Total Time	# of Students
A range	04:18:25	02:32:16	00:39:10	07:29:51	7
B range	04:39:53	00:20:54	00:30:59	05:31:45	11
C range	08:12:25	04:49:36	01:26:51	14:28:52	6
D	05:21:00	00:06:58	00:00:00	05:27:58	1

MyEconLab for each final grade range (A through D). The last column of the table reports the number of students in each grade range.

The results show that there is a negative relationship between the average time students spent completing MyEconLab homework assignments and their final grade. This is not surprising taking into consideration that better students are likely to know well the subject matter and have a better understanding of the main concepts compared to their peers who received lower grades and because of that they did not need as much time to work on these assignments or alternatively they did not need to use the two attempts per question. An exception is the student who got a D in the class. This individual did not complete all of the homework assignments and that also affected his/her course grade.

An interesting pattern emerged between the mean time spent on optional tasks on MyEconLab and students' performance. Students in the A range spent more time on average completing practice questions as part of either the Study Plan or MyEconLab tests than students in the B range. However, students in the C range stayed much longer online (two to three times more on average) to do practice questions. An explanation for this can be that they struggled with the course material and to avoid falling behind their peers they needed an additional work in order to catch up. The same pattern is evident for the total time spent on MyEconLab working on various tasks by grade range.

Table 3 reports the Pearson product-moment correlation coefficients between students' grades measured in points and the time spent on completing homework assignments, practice questions from the Study Plan, tests, or total time. The correlation between the time spent on homework,

TABLE 3. Correlation between Times Spent on Different MyEconLab Tasks and Grade.

Grade Ranges	Homework	Study Plan	Tests	Total Time
A and B only	–0.07827	0.30333	0.16364	0.19318
All Grade Ranges	–0.29996	0.15433	–0.08446	–0.11086

tests, or total time spent on MyEconLab for students in all grade ranges and final grade is negative but statistically insignificant at the 5% level. The correlation between final score and the time students spent working on practice questions in the Study Plan is positive but relatively weak ($r = 0.1543$). When just students in A and B grade ranges are considered (18 students), the Pearson correlation coefficient is negative only for the time spent on completing homework assignments and is positive for the other two tasks (tests and Study Plan), and also positive for the total time spent on MyEconLab. These results are in accordance with Table 2 and the explanations provided above. Regretfully, the t-tests for the significance of the correlation coefficients show that these numbers are statistically insignificant. In particular, the null hypothesis of having the population correlation equal to zero cannot be rejected in each of the cases at the 5% significance level. A possible explanation is that not many students actually used MyEconLab besides the required homework assignments—only very good students and those struggling with the material took advantage of the different activities available on MyEconLab. This is confirmed by the analysis of the relationship between the number of correctly answered questions and the student grades. For instance, only eleven students used the Study Plan feature (44% of the class). The correlation between the number of correct answers on practice questions and the course grade measured in points is 0.1257. It is positive but statistically insignificant at the 5% level.

5. Discussion and Conclusion

There has been limited research on the benefits of MyEconLab or other web-based interactive learning systems developed to supplement teaching and learning in various business courses. This paper attempted to provide more quantitative as well as qualitative analysis of the benefits of MyEconLab. A survey of student perceptions about the use of MyEconLab as a complimentary instructional tool in an undergraduate international economics course was administered in the fall of 2010. The survey results revealed that overall the respondents were satisfied

with this online interactive study platform and thought that the practice problems they completed using this system were beneficial and contributed to the improvement of their grades. More than 80% of the students indicated that it advanced their understanding of the class material and said that they would recommend the use MyEconLab for this class. One unexpected result was that not many students used the Study Plan and only 50% of those that took advantage of this feature reported that it contributed to their understanding of the subject matter while about 45.5% of them could not determine if it was beneficial or not to their comprehension of the material.

The study of the relationship between students' performance and the time spent on the completion of different MyEconLab activities showed some interesting patterns that were not apparent in the previously-mentioned case studies described in the literature review section. In particular, the students with a final grade in the A range did not need as much time as the other students in the class to finish their homework assignments. The same applies to students in the B range compared to those with a final grade in the C or D ranges. In other words, the data revealed a negative association between the course grade and time necessary to complete a homework assignment. In contrast, the best students in the class spent more time working on optional practice problems on MyEconLab than students in the B range. The opposite was true for the students in the C range. Most probably they had difficulties understanding the course material and because of this they stayed much longer online doing practice questions or taking the optional exams for each chapter.

The correlation analysis confirmed these patterns. The computed Pearson correlation coefficient revealed a positive correlation between the final course grades of all students and the time they spent on MyEconLab completing practice questions as part of the Study Plan. The same result holds for students in the A and B ranges when they are considered separately. The correlation between course grades and the time spent on optional tests or the total time spent on MyEconLab was also positive for this subgroup of students but it was negative for the students in the whole sample (i.e. in all grade ranges) reflecting the pattern described above.

However, these correlation coefficients were found to be statistically insignificant at the 5 percent level of significance. A possible explanation for this result can be the lack of incentives for the students in the B range to utilize more MyEconLab. As mentioned before not many students used the different features of this online learning platform and because of this the correlations were not strong. Another possible explanation can be the relatively modest share of MyEconLab in terms of a student's final course grade—just 13%. It should also be mentioned that besides the online homework assignments, the students in this class had to work on and submit 4 group assignments, as well as to write an individual project toward the end of the semester. The large number of required assignments might have affected the ability of students to complete optional exercises on MyEconLab. A further investigation of the strength and the significance of these relationships are necessary to determine the prevailing patterns. Of course, the results depend on many other factors beside the ones considered in this study.

It will be beneficial to look at the impact of MyEconLab on student learning using multiple regression analysis with different control variables such as student-specific characteristics, instructors' teaching approaches, etc. The limitation of this paper was the relatively small sample size which did not allow for the use of regression analysis, as well as the lower weight put on MyEconLab activities in terms of students' final course grade that might have influenced the results. Another important question that needs more research is whether and how the online learning systems such as MyEconLab improve student performance over time. If the results of such analyses provide significant evidence for the effectiveness of web-based interactive learning platforms on student performance, as it is claimed by their designers, this knowledge can convince other instructors to use MyEconLab, or other online systems in their business classes. That will ultimately benefit students by helping them learn the material and retain it longer. The enhanced learning possibility will improve students learning experience by providing more pleasure from higher education and contributing to the development of their human potential.

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