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# The Impact of an Internet-Based Computer Laboratory on Graduate Students' Learning of Econometrics

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## Abstract

With an increased use of modern ICT methodologies in teaching econometrics, additional research is needed to evaluate their effects on students' learning of econometrics. The purpose of this paper is to empirically investigate how the Internet-based computer laboratory at Ss. Cyril and Methodius University in Skopje, Faculty of Economics influenced graduate students' learning of the subject Econometrics. This paper summarizes both teachers' and students' experiences in the teaching-learning process of Econometrics at graduate level in a computer laboratory. Teaching and learning econometrics in a computer lab has advantages and disadvantages for both, teachers and students. However, in this paper we have shown that the benefits of the computer laboratory outweigh its drawbacks and conclude that the computer laboratory at the Faculty of Economics-Skopje has been successfully used both for teaching and learning of Econometrics.

**Keywords:** teaching econometrics, learning econometrics, ICT, computer laboratory econometric software, EViews

**JEL classification:** A23, C10, C18

## Introduction

An important change that has had a significant impact on teaching and learning statistics and econometrics over the past few decades has been the increased application of microcomputers and of user-friendly computer packages, particularly at university level. Today more and more university professors of econometrics worldwide have access to modern computer classrooms. Only two decades ago we would have thought that this was an impossible luxury. With the penetration of computers and econometric computer packages, the teaching and learning scene of econometrics has changed for the better. With current tools – a PC and a user-friendly econometric software – it is now possible to solve econometric problems without spending inordinate amounts of time calculating the solution.

According to Murray (1999) teaching in computer classrooms is exciting because of the possibility of better teaching, but also daunting because of new challenges and pitfalls for teachers of economics. With this integration it is possible to concentrate on teaching the assumptions and theoretical issues of econometrics, instead of teaching mathematical calculations. The tutorials and the examples made during the classroom and lab hours enable the computer to become more than a simple computation tool; it can be a learning tool.

With the increased use of computers and software in instruction and learning the increased use of computer technology and software in econometrics instruction and learning, additional research and discussion is needed on the appropriate ways to

apply computers and software in econometric classroom in order to get the students interested in econometrics. Although there are many articles examining the effect of the use of computers and software in teaching econometrics, only a few of them are empirically based.

Becker and Greene (2001) analyzed the essential topics to be taught to undergraduates in statistics and econometrics and pointed out the following main problems in the traditional instruction: (i) abstract and dry textbooks and (ii) use of problem sets of made up data and unrealistic numerical examples. According to Pérez and López (2009): "In the framework of the Bologna process the new Economics and Business Degrees must face the challenge of training individuals capable of analyzing and interpreting the functioning of the economy improving the well-being of the society with the achievement of equity and efficiency. With this aim, Econometrics should be considered as a strategic tool whose teaching-learning method should be designed paying special attention to competences as problem solving, decision-making or information management".

Although an immense supply of textbooks in econometrics exists, there is little attention paid on the applications of concepts and procedures. To engage students more in class it is necessary to use examples, exercises and problems based on real data. The purpose of this paper is to bridge this gap by describing how the use of computer technology and software (particularly EViews 6), have influenced the teaching-learning process of Econometrics taught at graduate level at "Ss. Cyril and Methodius" University, Faculty of Economics-Skopje and to share my experience with computer laboratory during the last ten years combining teachers' and students' points of view. I assert that only by adopting a lecture/laboratory format econometric theory and its application in economics and business can be brought together to improve students' learning.

## Methodology

There is no doubt that a computer laboratory poses new opportunities as well as challenges in the teaching-learning process. In this paper I summarize my ten years' experiences in teaching Econometrics at graduate level at "Ss. Cyril and Methodius" University in Skopje, Faculty of Economics -Skopje with the help of the software EViews 6. In order to empirically assess the impact of an Internet-based computer laboratory on students' learning of the course Econometrics, I performed an anonymous student evaluation survey. The evaluation survey was made compulsory as part of the students' end of course evaluation and their final grades were made available for viewing only after completion of the survey. Ideally, to test the effectiveness of this method, one would like to be able to randomly assign students in the same class with the same instructor to a control group and an experimental group in which the students in the experimental group learned econometrics in a computer lab. However, since the computer lab is integrated into the entire subject, it is not feasible to perform an experimental design. An alternative method of measuring the effectiveness of a computer lab on students' learning of Econometrics is to ask students to provide information about their personal opinion of the computer laboratory. This kind of evidence can be found in an evaluation survey. Twenty-nine students who enrolled in the graduate program SMEBE participated in the evaluation survey.

## Teaching Econometrics with EViews 6 – summarized experiences

Following the requirements of the Bologna process for developing of competences as problem solving, decision-making or information management, I designed the subject Econometrics which is taught at graduate level at the Faculty of Economics-Skopje to have a strong focus on application of statistical and econometric methodology on real-world data in economics and business, with the ultimate aim to enable students to solve new and non-standard problems either individually or in teams. The SMEBE programme was delivered through a flexible combination of lectures in the multimedia centre of TEMPUS SMEBE, computer lab sessions and tutorials and projects. Lectures were used to introduce key theories, concepts and economic models. In classes the student had the opportunity to solve problems and numerical exercises, to analyse case studies, to make presentations of research published in academic journals. The computer labs provided students with the practical experience of using computer software to perform calculations and conduct realistic simulations. In addition, econometric methods were taught in lab sessions, thus students have had the opportunity to apply econometric software to empirical research.

My ten years' experience in teaching Econometrics in a computer lab shows that the choice of a suitable computer package is a very important issue for teaching-learning process. Among the available econometric software, EViews 6 has been chosen due to the following reasons:

- It is intuitive and easy to use both for the instructors and the students. Instructors can employ a wide range of statistical and graphical techniques without having to learn complicated command syntax, and students can concentrate on the substance of the course, instead on the complexities of the computer package.
- EViews 6 provides a wide variety of menu options including least squares estimators, maximum likelihood, generalized method of moments, single-equation and system methods, also offering a "console" option where users can type commands which are recorded as a batch file.
- The flexible character of EViews 6 offer teachers a possibility to combine the quick point-and click menu options with the use of some commands and console facilities in order to re-build specific results, improving the autonomous work and the comprehension of the main econometric concepts and techniques.
- EViews 6 allows analysing datasets whose size is limited only by an available computer memory. This is a precondition for implementation of the realistic approach of teaching and learning econometrics.
- Allows using data sets in their current format These data can be automatically converted into the EViews 6 work file format.
- EViews 6 has a session concept, which provides an iconic space containing several objects such as data sets, model tables, scalars, graphs etc. that allow users to save a complete file of the whole developed work

Another very important issue when lecturing econometrics in a computer lab, is the issue of controlling what students are using their PCs for during classes. Based on my teaching experience the software NetOp School, is one of the best tutorial software package for teaching, which gives a powerful tool for virtual and networked teaching. With this tutorial software it is possible to share any screen with the class, follow students as they work and give them help where and when it's

needed. Teachers can effectively control what students are doing with their computers, to monitor and take control of a student's computer, as well as project the screen of a student's PC so that everyone in class can see it. Use of such software discourages students from using their computers for anything that is nonclass related. NetOp School allows to monitor all students at once or individually from teacher's own desk, and take over a student's computer easily to provide assistance. Teacher can follow all students activities in real-time and allow or deny automatically specific programs and web addresses. It is also possible to control what applications have been used, distribute and collect documents from students and create and perform regular tests with immediate individual feedback.

It is quite obvious that computers can not replace instructors and teachers can not rely only on computers during instruction of econometrics. But because computers are very sophisticated devices, and may facilitate a variety of tasks, they have enormous benefits both as teaching and learning tools.

My ten years' experience has shown that teaching Econometrics in a computer lab using the computer package EViews 6 has the following advantages:

1. The computer lab creates learner-centred environment where the teacher takes role of an advisor and helper, and students can work at their own pace.
2. The computer laboratory offers more possibilities to instructors in preparing the lectures and in the process of lecturing.
3. The computer lab provides teacher of econometrics with greater flexibility in activities, which check students' comprehension and progress.
4. Instructors have direct feedback from students.
5. Computers can help teachers keep records of students' works and their own materials.

Unfortunately, computers are not free from weaknesses. During my two years' practice of teaching econometrics in a computer laboratory, I have come across that the computer lab poses a number of challenges and pitfalls for the instructors:

1. Computers can not replace teachers. They can not communicate with the students.
2. Teaching econometrics in computer lab requires more resources (smaller student to faculty ratio and reliable hardware and computer packages).
3. Maintenance and updating the computer lab is expensive.
4. Teachers need to have competence in computer laboratory use. Training programs should be offered to provide teachers of econometrics with the necessary skills that prepare them to effectively use the hardware and software in the
5. It takes much time to spend learning and exploring with computer lab technology. Clouse and Alexander (1998) state that it might take as long as six years to learn to integrate technology into the classroom environment. This can draw back teachers of econometrics from using the computer lab for teaching econometrics.
6. In order to take advantage of the computer lab, econometrics must be revised. The focus of the subject Econometrics Theory must be replaced from mathematical explanation to statistical reasoning and have placed additional emphasis on the use of the computer package Eviews.
6. Consequently, I had to write a completely new textbook "Econometrics with Application in EViews 6". Such efforts could be a barrier for experienced teachers to adopt the computer classroom in teaching econometrics.
7. High cost in time dedicated to creation of computer slide shows for the material presented.

8. Teachers have to handle the large heterogeneity among the students regarding their priorknowledge of statistics and computer skills. Many of the students were having difficulty with statistics. They tended to follow the lectures without understanding what was going on. A few of the students had difficulty using the computer.

9. Increased dependence of instructors on technical facilities. In case network is down, the computers do not operate, the overhead projector is broken etc.

10. As a result of upgrade of hardware and software, at the beginning of each semester and before each exam teachers should rerun the software in order to check for new glitches.

11. In order to avoid computer glitches during lectures, the computer material should be verycarefully prepared.

12. Instructors must monitor both the students and the technology.<sup>1</sup> In our case we have solved that issue with the educational software NetOp School 5.

13. In a computer lab, where the computer draws student's attention, instructors have to make greater efforts to keep students focused on content and not on technology.

14. Teachers must help students in managing the mental transition between listening and performing computing with their computers.<sup>13</sup>

15. Instructors should enable both strong and weak students to learn. However they should not allow the weakest student to dictate their pace of lecturing.<sup>14</sup>

16. Instructors have to take measures to encounter "technical cheating" during examinations. This is time consuming and requires utmost care.

17. Manual collection of examination files is also time consuming.

## Results of students' survey

Twenty-nine students who attended the subject Econometrics participated in the compulsory anonymous evaluation survey in January 2017 (after the end of the winter semester). They have stated the following advantages as the biggest benefits from learning econometrics in a computer laboratory:

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- Personal approach to students. In a small group of 29 students, all students, and especially weaker students receive increased attention.
- Focus on substance and not on writing down what the professor presents. Helps students pay attention and be more engaged.
- Having the screen directly in front of students made the material much more easier to follow.
- Students can download free of charge lecture and exercise notes and lab manuals from anywhere with any computer with Internet connection.
- Having the lecture and exercise notes as well as the lab manuals on any computer on the internet results in more effective study.
- Through lab sessions students can actually use the various techniques they learn in Econometrics;
- Lab sessions give an opportunity to students to demonstrate their knowledge in another way (not only though exams);
- The empirical understanding of the concepts through labs is better than one gained by reading a textbook.
- Working with real data sets favours understanding of statistical and econometric methods and helps develop students' interest in the subject.
- Current and easy access to information through Internet resources.



- More information flow between students and instructors.
- Students are more motivated and empowered by computers and software.

On the other hand, slow server and wireless problems in the computer lab have been considered as the biggest disadvantage by 93% of the students.

## Discussion

This paper tried to investigate the experiences of teachers and opinions of students towards Internet based computer laboratory in the teaching and learning process of the subject Econometrics at graduate level. The main finding is that the Internet based computer lab creates learner-centred environment where the teacher takes role of an advisor and helper, and students can work at their own pace. Another main finding of this study is that computer laboratory offers more possibilities to teachers and provides them with greater flexibility in performing their activities,

An analysis of students' opinions suggest that the use of an Internet based computer laboratory and the software EViews 6 has a beneficial effect on the learning process. Students were most positive in their comments regarding receiving a personal approach by the teacher, focus on substance, more engagement at classes, working with real data sets which resulted with an increased students' interest in the subject.

## Conclusion

There is no doubt that a computer laboratory poses new opportunities as well as challenges in the teaching-learning process of econometrics that require modifications in teaching style and approach. However, the effort expended to cope with these challenges is more than compensated by the opportunities that such laboratories present to utilize both hardware and software as teaching and learning tools. Since the establishment of the computer laboratory at the Faculty of Economics-Skopje in 2007, we have experienced the potential and have seen the drawbacks of the computer laboratory in the teaching and learning process of Econometrics. The benefits of the computer laboratory for both teachers and students seem to outweigh its drawbacks. Based on my ten years' experience and the results on the students' evaluation survey, we can conclude that the Internet based computer laboratory was successfully used both for teaching and learning of Econometrics.

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## About the author

Vesna Bucevska is a Full-time Professor at the Faculty of Economics -Skopje where she teaches Econometrics, Econometric Theory, Advanced Econometrics, Financial Econometrics and Statistical Quality Control at undergraduate, graduate and doctoral level. Her main research areas are statistics and econometrics in which she published six textbooks and more than 100 scientific papers in international scientific journals. She was also educated at leading European universities: Bocconi, Cambridge, Ludwig Maximilian, Chalmers University of Technology, University Carlos III Madrid, University Roma Tre etc. She has an excellent knowledge of many computer packages (EViews, Statgraphics Centurion XV, SPSS, SAS, Minitab). Author can be contacted at [vesna.bucevska@eccf.ukim.edu.mk](mailto:vesna.bucevska@eccf.ukim.edu.mk).