# STUDENT ACCEPTANCE OF ITT-SUPPORTED TEACHING AND INTERNAL COURSE ADMINISTRATION: CASE OF BUSINESS STATISTICS

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*It is a recognised fact that university courses, especially those dealing with issues of quantitative literacy, can benefit enormously from exploitation of modern information and telecommunications technology (ITT). The use of ITT is advantageous both in the teaching process and in the process of internal course administration, enabling a simplified access to course materials, a steady electronic communication flow between lecturers and students, etc.*

*Using the course on Business Statistics taught at the University of Ljubljana's Faculty of Economics to second year students of business as an illustrative example, the paper focuses on discussion of student acceptance of ITT-supported teaching and internal course administration. In this framework, differences in characteristics of students more respectively less inclined to accept ITT-supported teaching and internal course administration are explored in detail with the help of multivariate data analysis.*

## 1 INTRODUCTION

According to Owens (1995: 206), one of the dominant concepts that has emerged in the twentieth century is that of a planned, controlled and directed social change. It is a world-wide belief today that societies can consciously direct the forces of change to suit their predetermined goals and social values through knowledge.

In the second half of the twentieth century, education has come to be viewed as a key to equality and equity in all societies. In this sense, it "has been thrust into a central position in the political world, for deciding what equity is and what social values are … is clearly a political issue and not merely a technical educational issue. In order for an educational system to reflect the will of the political community, change in educational organisations cannot be planned and managed by educational policy makers alone: provision must be made for orchestrating the participation of all social groups involved" (Owens, 1995: 206).

Of course, educational organizations should not be regarded solely as vehicles for social and structural change. They are also expected to preserve and transmit traditional values to younger members of society (and thus represent stability in a rapidly changing world). At the same time, they have to react to rapid changes and offer access to new knowledge to active population as well (terms "continuous learning" and "life-long learning" are well known and frequently used when describing this phenomenon). It would thus seem that educational services nowadays must somehow succeed in integrating stability and change at the same time.

This is especially the case where increase in **quantitative literacy** of both general and student population is concerned. Quantitative literacy should be understood as a broader concept than **statistical literacy**[1] (ability to select, use, and interpret the results of the proper statistical method to solve a given problem). It should also include **computer literacy** (the ability to use the proper statistical software to solve a given problem). It could even be argued that **web (on-line) literacy** (the ability to find and access data and information on-line) is also an element of quantitative literacy, since a growing number of statistical sources is accessible on-line (Ograjenšek, 2002: 43)[2].

It is a recognised fact that university courses dealing with issues of quantitative literacy can benefit enormously from exploitation of modern, rapidly changing information and telecommunications technology (ITT). Fuller (2002) furthermore points out that statistical

curricula need to be adapted to changing opportunities generated by developments in ITT. Nevertheless, it has to be stated that statistical philosophy, inherent to all steps of the statistical production and dissemination process, represents the key element of the curricula stability. In other words, while ITT enables a simplified access to an ever increasing number of statistical web resources, a simplified access to course materials, a steady electronic communication flow between lecturers and students, easier and less time-consuming computing, etc., the underlying logic of statistical reasoning which should be conveyed to students in the teaching and learning process remains unchanged.

Using the course on Business Statistics taught at the University of Ljubljana's Faculty of Economics to second-year students of business as an illustrative example, the paper does not address the elements of curriculum stability. It focuses on the elements of change due to ITT-supported teaching and internal course administration. More specifically, attention is given to student acceptance of ITT-supported teaching and internal course administration. In this framework, we're trying to identify groups of students more respectively less inclined to accept these new forms of teaching and administration, and explore their characteristics with the help of one of the multivariate analysis techniques, namely the cluster analysis.

## 2 COURSE ON BUSINESS STATISTICS AT A GLANCE

The course on Business Statistics has been developed at the University of Ljubljana's Faculty of Economics parallel to the course on Economic Statistics[3]. The former is taught at the undergraduate college of business, the latter at the university level (both to the second-year students). The courses are obligatory for the whole generation. As a consequence, approximately 500 full-time students take the course on Business Statistics each calendar year (note that the number of part-time students enrolled into the course is usually as high as the number of full-time students).

Topics covered in the course include statistical units, classifications and registers, selected chapters from demographic statistics, introduction to the theory of index numbers (with emphasis on price, production, wage and productivity indices) as well as introduction to national accounting. In the future, several modifications of the course curriculum are planned to bring it more in line with its title, giving emphasis to business decision and information analysis in marketing, finance, operations, human resource management, etc., and including topics such as introduction to business data mining.

At present, the teaching process takes place in the form of lectures, group tutorials and a computer lab seminar. Attendance of lectures and tutorials is not obligatory. However, students are obliged to attend the computer lab seminar. In the past several years, student attendance of lectures has diminished due to two reasons:

- firstly, an elaborate course pack which includes a textbook (in a printed, CD-ROM and on-line version with links to web pages of institutional data and metadata providers), a study guide and a booklet of solved problems;
- secondly, the fact that lecture notes can be downloaded from the course web page prior to the lecture.

On the other hand, tutorials are well attended since numerous practical examples are presented and discussed in their framework (it has to be pointed out that lectures are more theoretically oriented).

The obligatory computer lab seminar has been introduced into existence in the academic year 1995/96 as the first ITT-supported form of teaching. Although reshaped several times due to the fast expansion of statistical resources available on-line, its structure remained the same. Topics such as demographic statistics and theory of index numbers are being upgraded with introduction of simulations in Excel. The simulation data files are also available to students on-line.

## 3 VIRTUAL CLASSROOM AND THE COURSE ON BUSINESS STATISTICS

Statistical education of today's students of business and future managers is a frequently addressed topic (see e.g. Ograjenšek and Bregar, 1999; Bregar, Ograjenšek and Bavdaž, 2000; Cryer, 2002; Hahn and Dassonville, 2002; or Tsankova, 2002). It is usually dealt with in the framework of a virtual classroom which is either "under construction" or already fully formed and offering a number of on-line courses.

The term virtual classroom and its meaning correspond very strongly to the term virtual factory that is regarded by Schuh (1997, p. 295) as a "promoter of structural changes". Virtual classroom could be described as a virtual knowledge factory that promotes structural changes in companies or in the society as a whole by educating and training people efficiently, flexibly and at relatively low costs using a new educational model. Reinhardt (1995, p. 52) describes changing educational paradigms by comparing the old and new educational models and pointing out the necessary technological implications (see Table 1).

***Table 1: Changing Educational Paradigms***

| Old Model | New Model | Technology Implications |
|---|---|---|
| Classroom lectures. | Individual exploration. | Networked PCs with access to information required. |
| Passive absorption. | Apprenticeship. | Skills development and simulations required. |
| Individual work. | Team learning. | Benefits from collaborative tools and e-mail achieved. |
| Omniscient teacher. | Teacher as a guide. | Access to experts over network relied on. |
| Stable contents. | Fast-changing contents. | Networks and publishing tools required. |
| Homogeneity. | Diversity. | A variety of access tools and methods required. |

*Source: A. Reinhardt, New Ways to Learn, 1995, pp. 52.*

Membership in a virtual classroom brings participants (e.g. students, trainees, etc.) the following important advantages (Barker, 1995: 54):

- possibility of simulating real-life environments and actions (e.g. stock market trends, surgery procedures, flying of an airplane, etc.) while not leaving either home or the working place;
- self-paced learning;
- lowering of the intimidation factor (e.g. fear of loosing face in direct confrontations with other students);
- increased one-to-one and group interaction (via e-mail, chat groups etc.);
- access to more information (still, one has to have a guide in a modern information maze).

Obviously, the teacher role still remains very important although it has been tremendously changed. Also, the fact that theory and practice are combined in a virtual classroom should minimise the danger of quickly loosing the acquired knowledge.

As already stated, the course on Business Statistics taught at the Faculty of Economics in Ljubljana takes place in a traditional classroom. However, several elements of a virtual classroom have been introduced into the teaching process in the period of the past eight years. These elements include:

- **Incorporation of links to web pages of external data and metadata providers into in-class presentations, lecture notes and other study materials (the textbook and the study guide).** The contents and logic of the textbook in its on-line form are described in detail in Bregar, Ograjenšek and Bavdaž (2000: 237-249).
- **Web dissemination of study materials, test examples, homework solutions, answers to frequently asked questions, etc., from the course web page.** The web

page (*http:www.ef.uni-lj.si/predmeti/poslstat*) has been operational since the academic year 1998/99. It has undergone several major transformations (the last one to conform to the faculty web template). In the process it has become the primary source of course information for more computer- and web-literate students.

- **ITT-supported internal course administration.** Course administration is not limited to e-mail. However, we deem it an interesting example of ITT-induced change. It could be stated that ever since the advent of the e-mail there has been a noticeable trend towards less face-to-face student-teacher interaction during the regular weekly office hours. Lately, students tend to use office hours only as a platform for discussion of their pre-exam and exam results. All other issues (including solutions to problems from the study guide, questions concerning pre-exam and exam order, computer lab seminar enrolment, etc.) are increasingly being addressed by e-mail.

Elements of the virtual classroom, which are discussed in the previous paragraphs, are not the only ITT-supported forms of teaching and internal course administration pertaining to the course on Business Statistics. For one, computer lab seminar also has to be mentioned. Following is a presentation and discussion of a survey aiming (among other things) to assess our students' acceptance of these forms.

## 4 ITT-SUPPORTED TEACHING AND INTERNAL COURSE ADMINISTRATION: MEASUREMENT OF STUDENT ACCEPTANCE

### Data collection

Our survey was conducted among the full-time second-year students of Business Statistics. The course on Business Statistics takes place in the fall semester (from the beginning of October to mid-January). Ideally, the survey would be carried out during tutorials in the last week of semester among all enrolled students. However, we decided to conduct it in the last working week of December 2002 among all students present on site (there was only one more session planned for January 2003 and we feared a major drop in class attendance[4]). We thus ended up with neither a census nor a probability sample. Instead, ours is a convenience sample of 274 units.

It has to be acknowledged that the students not attending the tutorials could differ from those that are either regular or sporadic attendees. Consequently, the survey conclusions might only apply to students participating in tutorials, thus being able to compare ITT-supported and non-ITT- supported activities.

### Methods and Results

An exploratory multivariate analysis (the hierarchical cluster analysis) is used to investigate the collected data. The analysis is based on the variables that examine different aspects of the pedagogic process in the framework of the course on Business Statistics as observed from the viewpoint of our students:

- Students' evaluation of/opinion on the difficulty, attractiveness and usefulness of a particular pedagogic activity, i.e. lectures, tutorials, and the computer lab seminar. The variables are measured on a 7-point scale (with –3 standing either for "not difficult", "not attractive" or "not useful" and +3 standing either for "difficult", "attractive" or "useful").
- Students' attendance of the non-obligatory lectures and tutorials.
- Students' expectations regarding their final grade.

On the basis of squared Euclidean distances and Ward's cluster method, three clear clusters of students are identified: "enthusiasts" (n=58), "critical selectors" (n=65), and "the reluctant" (n=32). The rest of the students (n=119) are excluded from the cluster analysis due to the problem of missing values dispersed across the variables. However, the good news is that the mean values (or percentage structures where applicable) of this "excluded" student group are within the bounds of the global average. The "excluded" seem to be quite similar to the "critical selectors" who are placed between the "enthusiasts" and "the reluctant". On the basis of this check-up we therefore conclude that the listwise exclusion as described above does not pose severe limitations on our results.

Among the identified three clusters, the "enthusiasts" are those that evaluate all pedagogic activities as the most difficult, attractive and useful. In particular, they grade lectures as being quite demanding (mean of 1,43), useful (mean of 1,50) and still interesting (mean of 1,07). Similarly, they rank the tutorials as being quite demanding and interesting (means of 1,71 and 1,72 respectively) as well as very useful (mean of 2,31).

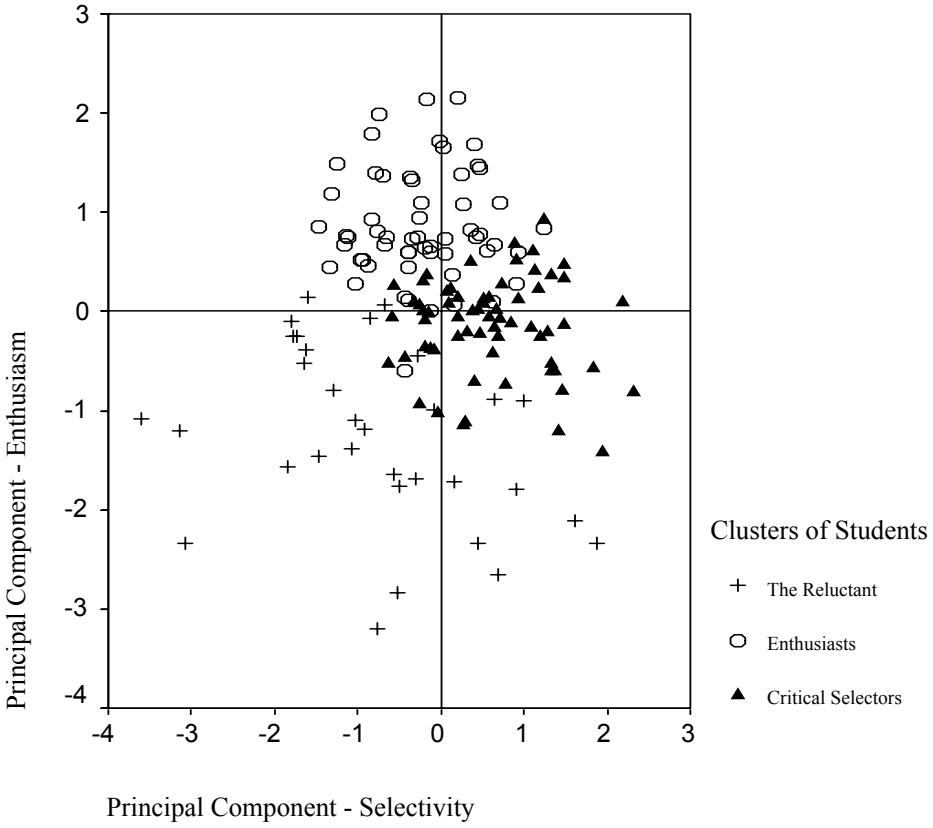


***Figure 1: Cluster Membership Plotted against the Two Principal Components***

The "critical selectors" find lectures still demanding and useful (means of 0,54 and 0,34 respectively), but to a lesser extent than the "enthusiasts". Also, they find lectures slightly less interesting (mean of -0,43). Compared to the "enthusiasts", they consider the tutorials noticeably less demanding, less interesting but similarly useful (means of 0,65, 1,58 and 2,28 respectively).

The "reluctant" judge lectures to be still a bit demanding, but not really interesting or useful (means of 0,47, -0,84 and -0,22 respectively). Similarly, among all clusters their ranking of the attractiveness and usefulness of tutorials is the lowest (mean of -0,09 and 0,56 respectively). However, they find these classes more demanding than the "critical selectors", yet still less demanding than the "enthusiasts" (mean of 1,13).

For all clusters, the obligatory **computer lab seminar** is deemed to be the least demanding among the pedagogic activities. However, the students from different clusters

perceive this activity from different perspectives. For the "enthusiasts", it is neither demanding nor easy. It is, however, very interesting and useful (means of 0,09, 2,36 and 2,40 respectively). For the "reluctant", quite the opposite can be stated: the seminar is not demanding but neither particularly interesting or useful (means of -1,25, -0,47 and -0,28 respectively). The "critical selectors" can be found in the middle: in their opinion, the seminar is not particularly demanding, but it is quite interesting and useful (means of -0,62, 1,34 and 1,55 respectively).

The average **attendance of lectures** is similar across all clusters; the "enthusiasts" attended more than half, the "reluctant" less than half, and the "critical selectors" around half of them. However, a more scrupulous examination of data reveals different distributions: more than twenty percent of the "critical selectors" and thirty percent of the "reluctant" went to only one or two lectures, while just five percent of the "enthusiasts" acted this way; nearly twenty percent of the "enthusiasts" went to all lectures, while the share of the "critical selectors" and the "reluctant" is minor. The **attendance of tutorials** was generally higher than that of the lectures; the "enthusiasts" have again the highest proportion of those that did not miss any of the classes (83%) and the "reluctant" the lowest (59%).

Distributions of the **expected final grade** show that no student expects to either fail or pass the exam with the highest possible grade. The "critical selectors" are the most ambitious: 23% of them expect a very good grade, while there are only 10% of such "enthusiasts" and 6% of such "reluctant". The same pattern can be found at the opposite end of the distributions: only 28% of the "critical selectors" expect to pass with the lowest grade, while there are 47% and 41% of such "enthusiasts" respectively the "reluctant".

The clusters are **further profiled** using the following characteristics:

- students' attitude towards ITT-supported pedagogic activities that would replace traditional lectures and tutorials;
- students' main information source on the course;
- variables concerning the Business Statistics web page: use of the web page as well as students' opinions on its organisation and usefulness;
- students' general interest in statistics;
- socio-demographic variables: gender, age, type of high school, type of final exam in the high school, high school grade average, and student part-time employment.

It could be claimed that students from all clusters on average support the **replacement of traditional pedagogic activities**, such as lectures and tutorials, **with modern ones**, such as e-assignments, discussion groups, search for and use of data and information available on-line, etc. The "enthusiasts" are again the keenest on the idea (mean of 1,60) and have the largest proportion of those strongly supporting the initiative (32%), followed by the "reluctant" and the "critical selectors" (means of 1,17 and 0,93; shares of 31% and 22% respectively). In fact, the largest share of the opponents to the proposal is found among the "critical selectors" (20%), a lower one among the "reluctant" (14%) and the lowest among the "enthusiasts" (8%). The same order applies to the share of the neutral (19%, 14% and 12% respectively).

The majority of students (75% of the "enthusiasts", 74% of the "critical selectors" and 64% of the "reluctant") mark professors and teaching assistants as their **main information source on the course contents and administrative procedures**. The only other information source that achieves a noteworthy result is the Internet in general (i.e. not necessarily the course web page): 12% of the "enthusiasts", the same proportion of the "critical selectors" and 23% of the "reluctant" regard it as their main information source.

Interestingly, the share of students that have ever visited the **Business Statistics web page** (by themselves) is the largest among the "critical selectors" (amounting to 95%) and somewhat lower for the "enthusiasts" and the "reluctant" (88% and 84% respectively).

However, if only those students that have visited it are considered, then as high as 27% of the "reluctant" select the web page as their main information source (compared to 14% respectively 12% among the "enthusiasts" and the "critical selectors"). Still taking into account only those that have visited the web page, it can be shown that on average students find it well organised and useful. Its usefulness scores even higher than its organisation. There are, however, some differences among the clusters. The "enthusiasts" grade both usefulness and organisation the highest (means of 1,98 and 2,12), the "reluctant" the lowest (means of 1,20 and 1,50 for), while the "critical selectors" remain in the middle (means of 1,60 and 1,91).

Students' **general interest in statistics** varies across clusters. Once more the "enthusiasts" express the highest interest (mean of 1,21); the proportion of those that find statistics at least slightly attractive amounts to 83%. Not very differently, the "critical selectors" on average grade statistics as interesting (mean of 0,66); the share of those at least a little interested in statistics still being high (73%). On the contrary, the average interest of the "reluctant" is below the midpoint (mean of -0,19) with only 39% of those at least vaguely attracted to statistics. Correspondingly, the reversed order can be found when examining the share of students that are not attracted by statistics. The proportion of the neutral is the highest among the "reluctant" (26%) compared to the "critical selectors" (10%) and the "enthusiasts" (11%).

The cluster of "enthusiasts" has the highest proportion of women (93%) and a slightly higher average age (21,6 years). The other two clusters both have the proportion of women around 73% and the same average age (21,4 years).

In all clusters, the students prevalently come from **high schools** with major in economics; the highest proportion is reached among the "enthusiasts" (64%) followed by the "critical selectors" (57%) and the "reluctant" (52%). Two other characteristics can be observed: the share of the students coming from grammar schools is considerably higher among the "critical selectors" (19%), while the share of the students coming from vocational high schools with major in business, commerce or administration is notably higher among the "reluctant" (24%). Consequently, the "critical selectors" have the largest proportion (22%) of those students who have taken the more demanding national final exam (in Slovene called "matura") and had the highest grade average.

Finally, 57% of the "enthusiasts", 51% of the "critical selectors" and 52% of the "reluctant" performed some sort of **work** during the fall semester. However, the "critical selectors" seem to be the most involved in part-time jobs, since 67% of them worked daily or at least some days of the week, while the same is true for 55% of the "enthusiasts" and 44% of the "reluctant".

## Discussion

The goal of this paper was to find out whether there exist groups of Business Statistics students with different inclinations to accept the ITT-supported forms of teaching and internal course administration. If yes, additional goal was to explore their characteristics.

The results confirm our assumption of students' non-homogeneity with regard to acceptance of ITT-supported teaching and administration. Three notably different groups of students could be identified:

- the "enthusiasts" that find all types of pedagogic and support activities most demanding, most interesting and most useful;
- the "reluctant" that are on the opposite end compared to the "enthusiasts";
- the "critical selectors" that are carefully placed in the middle – sometimes quite similar to the "enthusiasts" and sometimes to the "reluctant".

The "enthusiasts" are the most grateful audience, they are easily satisfied, and they accept everything that is on offer. Their enthusiasm could act as a motivator for the teacher's work. However, we are wondering if it is enough for an ambitious teacher to have a class full of nodding students. A useful feedback incorporating constructive criticism would be equally (if not even more) welcome. It could hardly come from the "enthusiasts", but rather from the "critical selectors".

Another question is how much attention (if any) should be paid to criticisms expressed by the "reluctant". Not only do they find all pedagogic activities least attractive and useful; they also judge the lectures and the computer lab seminar not to be either interesting or helpful. Even the tutorials that are praised for their attractiveness and usefulness by the other two groups leave the "reluctant" unaffected.

One possible explanation for this unfavourable evaluation could originate from their low level of general interest in statistics. Our course is not the first course on statistics they are obliged to take. Many students already get acquainted with statistics in high school, others in the first year of their undergraduate studies. The nature of this past experience possibly influences their interest in statistics as well as their attitude towards business statistics. In any case, the teacher's job is not an easy one – to break down a negative attitude, to gain the students' interest and/or to retain it. Maybe the biggest challenge is to stir the neutral (and these have the highest share among the "reluctant") that lack any interest.

As already stated, the course consists of three types of pedagogic activities: the computer lab seminar is a fully ITT-supported form of teaching while the lectures and the tutorials preserve the traditional form. The computer lab seminar is very well accepted among the "enthusiasts"; for them, it is the most interesting pedagogic activity and even slightly more useful than tutorials although the least demanding one. The "critical selectors" mark the seminar as attractive and useful but not to the same extent as the tutorials; they also recognize that it is not really difficult. It seems that for these two groups the seminar is an attractive way of achieving new knowledge. The same could not be supposed for the "reluctant". They deem the seminar to be the least useful pedagogic activity and not a really interesting one. At the same time, they (of all three groups) also perceive it as the least demanding of all pedagogic activities. It could therefore be argued that the "reluctant" find the computer lab seminar to be too easy to be interesting, while for the other two groups it is just easy enough to be interesting.

Furthermore, the analysis gives some indications that the "reluctant" could be more familiar with the ITT or even more inclined to using it regularly. For example, among the "reluctant" the share of students who regularly use Internet as their main course information source is the highest (although professors and teaching assistants still remain the main information source for the majority). They support the idea of replacing the traditional pedagogic activities with ITT-supported forms despite their bad experience with the computer lab seminar.

The favourable inclination towards ITT-supported forms could also be found among the "enthusiasts" and the "critical selectors" although the latter give the impression to be the most unwilling to change. Obviously, the "enthusiasts" can be easily convinced to adopt ITT-supported activities while the otherwise "reluctant" may view these new forms of teaching to be more adapted to their habits, skills and preferences. The prudence of the "critical selectors", however, prevents them to be too excited about the new forms of teaching.

From the teachers' point of view, another encouragement for the introduction of ITT-supported activities is the high proportion of students (regardless of the cluster membership) that have ever visited the course web page. It is important to know that those who visited it find the web page useful and well-organised.

Finally, as far as the students who were not interviewed are concerned, it would be very interesting to see whether and how they differ from those attending the traditional pedagogic activities. A rough guess would be that they are quite similar to the "reluctant" since this

cluster has the lowest attendance of tutorials. However, such a statement is nothing more than an educated guess. A detailed research would be needed to confirm such a hypothesis.

## 5 CONCLUSION

ITT-supported teaching and administrative activities, which are elements of a virtual classroom by default, are also increasingly reshaping the face of a traditional classroom. In our investigation we tried to find out whether there exist groups of Business Statistics students more respectively less inclined to accept the ITT-induced changes.

Our main conclusion is that these changes are not equally acceptable to all student groups. The best pedagogic approach would be to custom-tailor different ITT-supported activities according to their computer and web literacy levels, abilities, and interest in statistics. However, the question is how to carry out such customization under present circumstances characterised by the fact that only three teachers are available for a group of around five hundred full-time students.

In our future research on the acceptance of ITT-supported teaching and internal course administration, we plan to further profile the identified clusters of students using their pre-exam and final exam grades for the course on Business Statistics. In addition, we also plan to explore the option of replicating the study discussed in this paper (based on a sample of full-time Business Statistics students) for part-time students of Business Statistics and full-time students of Economic Statistics. By conducting such a comprehensive comparative study we hope to gain many important insights that should help us plan further ITT-induced modifications of teaching and internal course administration.

## 6 ACKNOWLEDGEMENTS

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## 7 NOTES

(1) The issue of statistical literacy was broadly discussed at the Sixth International Conference on Teaching Statistics in Cape Town/South Africa in 2002 (see e.g. Schield, 2002; or Moreno, 2002).

(2) McLean (2002) claims that the ability to make informed decisions is also an important characteristic of what he terms a "statisticate" person (in our text this category significantly overlaps with the term "quantitatively-literate" person).

(3) For more details concerning the course on Economic Statistics see Bregar (2003).

(4) It has to be pointed out that in the period October - December 2002 no major shifts in attendance were recorded. This is probably due to the pre-exam our students are obliged to take in the last working week of December. The word of mouth has it that the practice of the last minute cramming does not guarantee a passing grade.

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