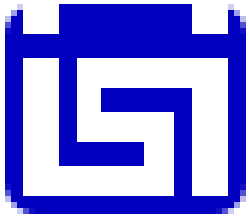

International Association for Statistical Education

IASE/ISI-Satellite Conference on

Assessing Student Learning in Statistics

Cultural Centre Vila Flor
Guimarães, Portugal

19-21 August 2007

http://www.stat.auckland.ac.nz/~iase/conferences.php?show=iasesat07

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This conference was made possible by the support and cooperation of

International Statistical Institute
International Association for Statistical Education
Officina Mathematica, Guimarães
Statistics Discipline, Swinburne University of Technology, Australia

A CD is provided to all registered participants which includes all the information in this booklet plus the complete papers in pdf format. A limited number of additional CDs maybe available from the organizers – contact bphillips@swin.edu.au.

Preface

Gilberte Schuyten, President IASE 2005-2007

This is the fourth ISI Satellite Meeting of IASE. These short satellite meetings are proving very popular, giving participants the opportunity to spend up to two days focusing on a special interest topic before immersing themselves in the sometimes overwhelming atmosphere of an ISI Biennial meeting. Each has been intended to be of interest to a wide cross section of society including teachers, educational administrators, and researchers in statistics education.

The first IASE Satellite Conference was held before the 53rd Seoul ISI Biennial Session in 2001. It gave the opportunity for 60 participants to enjoy 15 presentations given by people who had a special interest in *Statistical Literacy*.

With the success of the first satellite meeting, a second Satellite Conference was held just before the 54th Berlin ISI Biennial Session in 2003. The theme of the meeting was *Statistics and the Internet*. Refereeing added an important dimension in improving the academic standing of the 17 papers. The third IASE Satellite Conference was held in 2005, and preceded the 55th ISI Biennial Session in Sydney. The theme was *Statistics Education and the Communication of Statistics.* The 24 presentations included discussions of the main components in statistical communication and the relevance of statistical communication in the general education of citizens. This satellite was also of interest to policy makers, journalists, health professionals and others from the general population.

The driving forces behind these Satellites are former IASE president Brian Phillips and IASE vice-president Larry Weldon. This year Brian, chair and editor, is joined by Beth Chance as co-chair and Larry Weldon as co-editor of the proceedings. Our warm thanks to the local organizer Bruno C. de Sousa for the support offered by the Officina Mathematica at the Guimarães University to make this meeting possible.

The theme of this fourth meeting, *Assessing Student Learning in Statistics* is particularly of interest to statistics educators. At the time of writing this preface, there were over 70 registrations with 43 talks and 13 posters scheduled over two days, including a number which satisfied the refereeing process. This important increase in the flow of papers shows not only the growing interest in IASE Satellite Meetings, but also the overwhelming importance of the assessment theme to statistics educators. For the first time, due to the large number of presenters, we had to give up the preferred idea of keeping all participants together, and have to run parallel streams as well as having a poster session.

The papers are loosely organised into 7 categories *New Methods-Different ways to assess, New Tasks-Asking students different questions, Peer/Formative Assessment, Program Level (beyond student learning in a course), Research and Evaluation in Assessment, Statistical Literacy and Assessment, Writing in Assessment, and an additional Exam question session.*

Assessment is of course not an isolated final event at the end of the course or a program. The design and implementation of a program starts with learning outcomes described in terms of knowledge, understanding, skills, abilities and attitudes. These are followed by teaching, learning activities and assessment. It is a generally accepted statement that teaching, learning activities and assessment should be aligned with the intended learning outcomes. Assessment is not just the rounding off of the

teaching and learning period, but to a large extent it is a central steering element in those processes, and directly linked to learning outcomes.

I presume we all agree that we want our students to engage in learning tasks which adopt a deep approach characterized by students' intentions to understand and construct the meaning of the content to be learned, more than adopting a surface approach characterized by memorizing and reproducing the content. Students learn by doing and by having the teacher comment on how well they have done, where they have done less well and how to improve. This formative assessment is essential during a programme or course and feedback is essential. Almost any form of assessment can have a diagnostic function for both student and teacher. By seeing what has not been achieved, what has been achieved with little effort, what is excellent, and so on, both the teacher and the learner know where more work is needed.

The importance of the assessment theme cannot be overstated. If we want our students to become statistically literate citizens, I think we should stimulate a deep learning approach and align our assessment procedures. The way we organize and design our assessment has a high impact on students' learning approach and learning outcomes.

Looking to the program and seeing the wide range of papers in this satellite, I am confident that this meeting will be an important step for participants to deepen their thinking about assessment and for the IASE to offer ideas towards a state of the art of assessment in statistics education. I am looking forward to the conclusions and recommendations of this very important Satellite.

Gilberte Schuyten
President IASE
Head, Department Data Analysis
University Ghent, Belgium

July, 2007

Editors' Comments

Larry Weldon

Brian Phillips

The task of putting together the proceedings has taken two years in the planning, with a concentrated effort over the past few months. We feel we have a product we can be very proud of as statistics educators which will help advance our discipline. It will be most useful both to those attending the conference, as well as those who could not attend, to learn of the work of their colleagues from around the world who face similar issues about assessing students in statistics. A meeting like this only happens because of the commitment of a number of people from around the world who are prepared to freely give much time and effort. We would especially like to thank the International Organising Committee and the authors of the 43 papers and 13 posters for their great co-operation. A special thanks to the referees who gave so generously of their time and expertise to do such a professional job the help improve the quality of the papers. We also give special thanks to the Assistant Editor Tracey Shea who carefully checked the papers to ensure a high quality product.

Tracey Shea

Message from the International Organising Committee

Dear Colleagues and friends

We are pleased to provide a CD to participants that includes the proceedings of the IASE conference August 19-21, 2007, satellite to the 56th biennial ISI conference. The theme of the conference *Assessing Student Learning in Statistics* arose from discussion among IASE members. The presentations include discussions of the main components of assessment in statistical learning.

The approaches have been classified loosely as:

Statistical Literacy and Assessment
New Methods - Different ways to assess
Program Level (beyond student learning in a course)
New Tasks - Asking students different questions
Writing in Assessment
Peer/Formative Assessment
Research and Evaluation in Assessment

We thank all the authors, referees and editors who gave so generously of their time and expertise to do such a professional job to help improve the quality of the papers. We especially thank the local venue organiser, Bruno C. de Sousa, Universidade do Minho, Portugal, who has done a wonderful job in looking after the local arrangements. We thank the Assistant Editor, Tracey Shea, Swinburne University of Technology, for her great attention to detail in formatting and editing the papers to ensure they are professionally and consistently presented.

Finally, we are very thankful to the sponsors who so generously supplied support and cooperation to make this meeting possible. These were:

• International Statistical Institute
• International Association for Statistical Education
• Officina Mathematica, Guimarães, Portugal
• Statistics Discipline, Swinburne University of Technology, Australia
We hope you enjoy the conference.

The International Organising Committee

- Brian Phillips (Australia) (Joint Chair and Joint Editor)
- Beth Chance (USA) (Joint Chair)
- Larry Weldon (Canada)(CD writer and Joint Editor)
- Allan Rossman (USA)
- Ginger Rowell (USA)
- Gilberte Schuyten (Belgium)

Local Organiser

- Bruno de Sousa (Portugal)

Assistant Editor

- Tracey Shea (Australia)


Beth Chance


Allan Rossman


Bruno. de Sousa


Ginger Rowell

The Refereeing Process

Papers for inclusion in the proceedings as refereed publication were reviewed by at least two referees selected from a panel of peers. When requested by the authors, the full papers were reviewed and needed to be accepted by at least two referees before being accepted for presentation as a refereed paper. The review process was "double blind" - identification of both authors and referees was removed from the documentation. The papers that satisfied the refereeing process appear in the same proceedings as the other papers presented at the conference, and are identified with the symbol ® beside the title in the paper.

Referees

Gabriella Belli	*United States of America*
Gail Burrill	*United States of America*
Beth Chance	*United States of America*
Geoff Cumming	*Australia*
Neville Davies	*United Kingdom*
Joachim Engel	*Germany*
Paul Fields	*United States of America*
Mike Forster	*New Zealand*
Mary Gray	*United States of America*
Flavia Jolliffe	*United Kingdom*
Kay Lipson	*Australia*
Helen Macgillivray	*Australia*
John Marriott	*United Kingdom*
Alan Mclean	*Australia*
Irena Ograjenšek	*Slovenia*
Maria Gabriella Ottaviani	*Italy*
Peter Petocz	*Australia*
Maxine Pfannkuch	*New Zealand*
Brian Phillips	*Australia*
Roberto Ricci	*Italy*
Allan Rossman	*United States of America*
Ginger Rowell	*United States of America*
Gilberte Schuyten	*Belgium*
Michelle Sisto	*Monaco*
Doug Stirling	*New Zealand*
Larry Weldon	*Canada*
Chris Wild	*New Zealand*

Publication Details

Disclaimer

Although the Editors and Assistant Editor have made every effort to see that the papers conformed with the instructions given to authors, the content, condition and completeness of any paper is the responsibility of the author.

Layout of CD

The abstracts and papers on the CD are arranged in alphabetical order by the first author. The papers are provided in PDF format. PDF files can be opened, searched and printed but cannot be edited. You can search these files for authors, topics, keywords etc,, using the Adobe Acrobat Reader Find feature. You will need a copy of Adobe Acrobat Reader, which can be obtained for free from the Adobe Acrobat website, http://www.adobe.com/products/acrobat.

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Referencing

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Organisers

International Association for Statistical Education (IASE)
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The IASE, the International Association for Statistical Education, is a section of the International Statistical Institute, ISI, and was founded 1991 during the 48th Session of the ISI held in Cairo, Egypt. The IASE seeks to promote, support and improve statistics education at all levels everywhere around the world. It is the international umbrella organization for statistics education. It fosters international cooperation, and stimulates discussion and research. It disseminates ideas, strategies, research findings, materials and information using publications, international conferences, and increasingly, the web. IASE is the education section of the *International Statistical Institute* (ISI), but may also be joined independently by those who wish participate in IASE's activities, or simply to support the work on improving statistics education and extending its outreach. Full details of the IASE are found at http://www.stat.auckland.ac.nz/~iase.

IASE/ISI Satellite Conferences

This is the fourth IASE/ISI Satellite Conference. The first one was held in Seoul in 2001, the second one in Berlin in 2003 and the third one in Sydney in 2005. The aim of these satellite conferences is to enable ISI participants, teachers, and administrators interested in statistics education to have two days of focused exposure and discussion of topics in one area. Not only is the aim to interest a broader group than ISI participants, but also a more focused set of topics than the ISI. These satellite conferences have proven popular and we hope they continue to serve the needs of statistics educators.

Join IASE Now!

The IASE would like to encourage all people involved with statistics education to become a member of the major International Association for statistics educators. To see how to join the Association, please go to the website http://www.stat.auckland.ac.nz/~iase/members.php.

Local travel organiser

For further registration, hotel and travel information, please contact
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Conference Schedule

Location

Cultural Centre Vila Flor, Guimarães, Portugal

DAY	TIME	STREAM A	STREAM B
Sunday		**Room SA**	**Room S1**
Evening	5.00 - 7.00	*Welcome* Café-Concerto, Vila Flor	
Monday			
Morning	8.30 - 9.00	Registration & poster set-up	
	9.00 - 10.30	*Session one* Opening session	
	10.30 - 11.00	*Morning Tea*	*Morning Tea*
	11.00 - 12.45	*Session 2A* Statistical Literacy & Assessment	*Session 2B* New Methods: Different ways to assess (1)
	12.45 - 2.00	*Lunch*	*Lunch*
Afternoon	2.00 - 2.30	Posters	Posters
	2.30 - 4.00	*Session 3A* Program Level Assessment	*Session 3B* New Tasks: Asking different questions (1)
	4.00 -	*Tour & Dinner*	
Tuesday		**Room S1**	**Room S2**
Morning	8.45 - 9.00	Announcements	
	9.00 - 10.30	*Session 4A* Writing in Assessment	*Session 4B* Peer/Formative Assessment
	10.30 - 11.00	*Morning Tea*	*Morning Tea*
	11.00 - 12.45	*Session 5A* Research and Evaluation	*Session 5B* New Methods: Different ways to assess (2)
	12.45 - 2.00	*Lunch*	*Lunch*
Afternoon	2.00 - 3.00	Exam questions	Posters
	3.00 - 3.30	*Afternoon Tea*	*Afternoon Tea*
	3.30 - 5.00	*Session 6* New Tasks: Asking different questions (2)	

Monday 20th August

TIME	SESSION	STREAM A	STREAM B
Morning		**Room SA**	**Room S1**
9.00 - 10.30	***1***	*Opening Session* *Chair: Brian Phillips* 1.1 Petocz & Reid, Australia *Learning and Assessment in Statistics* 1.2 Burrill, USA *The Role of Formative Assessment in Teaching and Learning Statistics* 1.3 Jolliffe, UK *The Changing Brave New World of Statistics Assessment*	
11.00 – 12.45	***2***	*Statistical Literacy and Assessment* *Chair: Chris Wild* 2A.1 Schield, USA *Statistical Literacy: Factual Assessment to Support Hypothetical Thinking* 2A.2 Sanchez, USA *Building Statistical Literacy Assessment Tools with the IASE/ISLP* 2A.3 Budgett & Pfannkuch, New Zealand *Assessing Students' Statistical Literacy* 2A.4 Schuyten & Ferla, Belgium *Can Authentic Assessment Help in Delivering Competent Consumers of Statistics for Non-Academic Professions?* 2A.5 Lindmeier et al., Germany *Representations of Data and Manipulations Through Reduction – Competencies of German Secondary Students*	*New Methods – Different ways to assess (1)* *Chair: Kay Lipson* 2B.1 Novegil Souto & De Sousa, Portugal *A Techno-Pedagogical Design for Assessment within the Bologna Reform: A Cross-Border Experiment* 2B.2 Zetterqvist, Sweden *An Example of Assessment Being an Integral Part of a Service Course* 2B.3 Dickinson et al., USA *Summative Assessment Strategies For Statistical Learning: Development, Administration, and Scoring of Authentic and Performance Assessments* 2B.4 Gibson et al, UK *Assessing Statistical Problem Solving* 2B.5 Broers, The Netherlands *Designing Open Questions for the Assessment of Conceptual Understanding*

Monday 20th August

TIME	SESSION	STREAM A	STREAM B
Afternoon		**Room SA**	**Room S1**
2.30 – 4.00	***3***	*Program Level Assessment*	*New Tasks – Asking different questions (1)*
		Chair: Helen MacGillivray	*Chair: Gilberte Schuyten*
		3A.1 Peck & Chance, USA *Assessment at the Program Level: Using Assessment To Improve Undergrad Statistics Programs*	3B.1 Clarke, Australia *Objective Assessment of Forecasting Assignments Using Some Function of Prediction Errors*
		3A.2 Sundefeld et al, Brazil *Assessing the Inclusion of Biostatistics in Schools of Dentistry in Brazil*	3B.2 Svensson, Sweden *Assessing Learning By Student's Own Examination Tasks: Experiences from Research Courses in Biostatistics.*
		3A.3 Ottaviani & Ricci, Italy *The Transition from University to Work: A Case Study*	3B.3 Nikiforidou & Pange, Greece *Can Probability Combinations/Estimations Be Assessed In Preschoolers With the Use of Computers (Powerpoint)?*
		3A.4 Rybolt & McKenzie, USA *Assessing Student Learning in First-Year Quantitative Courses at Babson College: Experimental Design*	3B.4 Murphy, Ireland *Assessing Assessment: A Formal Study of the Benefits of Assessment in a Final Year Undergraduate Statistics Course*

Tuesday 21st August

TIME	SESSION	STREAM A	STREAM B
Morning		**Room S1**	**Room S2**
9.00 - 10.30	***4***	*Writing in Assessment*	*Peer/Formative Assessment*
		Chair: Bruno De Sousa	*Chair: Gail Burrill*
		4A.1 Earley, USA *Comprehensive Writing Assessments in Introductory Statistics*	4B.1 Parvate et al., USA *Fathoming Student Learning: A Survey Based Approach Using Fathom Surveys to Formative Assessment in an AP Statistics Classroom*
		4A.2 Biehler, Germany *Assessing Students' Statistical Competence By Means of Written Reports and Project Work*	4B.2 Bilgin & Fraser, Australia *Empowering Students to be the Judges of their own Performance through Peer Assessment*
		4A.3 Weldon, Canada *Assessment of a Writing Course in Statistics*	4B.3 Sisto, Monaco *Using Peer Assessment of Project Presentations to Develop Skills as Consumers of Statistical Information*
		4A.4 Imbos, The Netherlands *Thoughts about the Development of Tools for Cognitive Diagnosis of Students' Writings in an E-Learning Environment*	4B.4 MacGillivray, Australia *Weaving Assessment for Student Learning in Probabilistic Reasoning at the Introductory Tertiary Level*
11.00 – 12.45	***5***	*Research and Evaluation*	*New Methods – Different ways to assess (2)*
		Chair: Roxy Peck	*Chair: Neville Davies*
		5A.1 Nabbout, Lebanon *A Study of Discrepancies in the Assessment of Probabilistic Tasks: Why Might Teachers Grade and Evaluate Inconsistently a Given Answer?*	5B.1 Ridgway, Nicholson, et al. UK *Embedding Statistical Assessment Within Cross-Curricular Materials*
		5A.2 Posner, USA *Evaluating Pedagogical Techniques in Introductory Statistics: Proficiency Grading and Assignment Resubmission*	5B.2 Vega Quirós et al. Spain *How Much Do We Know About What Our Students Know of Statistics?*
		5A.3 Francis et al., Australia *Enhancing Student Understanding in Statistical Inference – Assessing the Effectiveness of a Computer Interaction*	5B.3 Capilla, Spain *Assessing Undergraduate Students of a Statistics Course in Environmental Science*
		5A.4 Lane-Getaz, USA *Toward the Development and Validation of the Reasoning about P-values and Statistical Significance Scale*	5B.4 Afamasaga-Fuata'i & Reading, Australia *Using Concept Maps to Assess Pre-Service Teachers' Understanding of Connections Between Statistical Concepts*
		5A.5 McKenzie & Rybolt, USA *Assessing Student Learning in First-Year Quantitative Courses at Babson College: Implementation and Analysis*	5B.5 Sorto, USA *Assessing the Knowledge of Future Middle School Teachers in Statistics By Lesson Design*

Tuesday 21st August

TIME	SESSION	STREAM A	STREAM B
Afternoon		**Room S1**	**Foyer**
2.30 – 3.00		*Exam Question Session* *Chair: Larry Weldon*	*Poster Session*
3.30 – 5.00	***6***	*New Tasks – Asking different questions (2)* *Chair: Beth Chance* 6.1 Da Silva Nascimento et al., Portugal *Let Us Do it in a Different Way? An Alternative Assessment Proposal* 6.2 Lipson, Australia *Assessing Understanding in Statistics* 6.3 Forster & Smith, New Zealand *Assessing Large Second Year Undergraduate Service Courses in Data Analysis* 6.4 Gal, Israel *Critical Areas for Assessing Skill Transfer: Statistics Education and PIACC*	

Poster Abstracts

Poster 1
LEARNING IN BIOSTATISTICS DISCIPLINES IN DENTISTRY (UNDERGRADUATE AND POSTGRADUATE STUDIES): AN EVALUATION PROPOSAL

AMBROSANO, Gláucia Maria Bovi
PEREIRA, Stela Márcia
TAGLIAFERRO, Elaine Pereira da Silva
MENEGHIM, Marcelo de Castro
PEREIRA, Antonio Carlos
WADA, Ronaldo Seichi
Piracicaba Dental School,
State University of Campinas (UNICAMP)
Brazil

This paper describes the experience of an evaluation method that can be applied to students of the Biostatistics discipline in order to judge their learning in the critical review of a scientific article. The stages of the evaluation method during the discipline are presented. This method is worthy for learning in the biostatistics discipline and for future updating of dentists by preparing them to critically review the dental literature.

Poster 2
PLAGIARISM IN STATISTICS ASSESSMENT - THE PISA PROJECT

BIDGOOD, Penelope, Kingston University, UK
HUNT, Neville, Coventry University, UK
PAYNE, Brad, Nottingham Trent University, UK
SIMONITE, Vanessa, Oxford-Brookes University, UK

There is much concern in British Higher Education (HE) Institutions that instances of plagiarism (the passing of someone else's work as though it were one's own) are on the increase. In response to this, assessment has become more focussed on traditional examination and/or on-line testing using large question banks and randomly created tests. Whilst they may be appropriate in many disciplines, these types of testing fail to address some important learning outcomes in Statistics, not least the ability of students to analyse a set of data appropriately and report results effectively. However, giving students the same data to analyse has serious risks of plagiarism, either in the analysis, or in the reporting. Group work, which is used to give students opportunities to develop team skills, has its own plagiarism problems. Various strategies have been developed by some lecturers to try to minimise the possibility of plagiarism in statistics - for example, giving each student a unique random sample from a larger data set or developing methodologies to allocate marks fairly in group work.

The Plagiarism in Statistics Assessment (PiSA) project was funded by the Mathematics, Statistics and Operational Research Network in England, to survey HE lecturers in statistics in order to investigate both methods of assessment and strategies used to deter plagiarism. The project aims are to identify and synthesise elements of good practice and disseminate these findings widely.

Poster 3
LET US DO IT IN A DIFFERENT WAY? AN ALTERNATIVE ASSESSMENT PROPOSAL

DA SILVA NASCIMENTO, Maria Manuel
Universidade de Trás-os-Montes e Alto Douro
DOS SANTOS VAZ MARTINS, José Alexandre
Instituto Politécnico da Guarda
Portugal

We believe that without the participation from students, effective learning will not be achieved. So, last year (2005/2006) we have tried to improve students learning in statistics using different assessment tools. Here we will present the proposal we have made to the students and we will discuss the results of one of the tasks we have proposed to the students. Finally, we will also discuss the effect of our proposal to improve students participative learning in statistics.

Poster 4
THE TEACHING OF STATISTICS AT UNESP-CAMPUS OF MARILIA: THE USE OF PROJECTS AS WORK PROCEDURE AND EVALUATION

GRACIO, Maria Cláudia Cabrini and de OLIVEIRA, Ely Francina Tannuri
UNESP/Campus de Marília
Marília SP, Brazil.

This paper presents a teaching experiment of Statistics applied to the Librarianship, Pedagogy, International Relations and Social Sciences courses at UNESP-Campus of Marília aimed at providing a better articulation between the contents of the discipline with the students' knowledge and working field. Considering that Statistics is a supporting tool in these areas, firstly an attempt was made to establish a pertinent content for each course, the identification of its peculiarities, specific objectives, appropriate measurement scales and evaluation procedures. On the assumption that Statistics as a supporting tool comprises a set of statistical methods and techniques, this approach proposes project development by the students, who collected data on issues related to their own interests. Thus both investigation practice and quantitative research were a means to move from a fragmented view of statistical knowledge to one favoring a real association with the students' area. The professors' and the students' evaluation of this teaching experiment showed that by stimulating the use of Statistics applied to different fields of knowledge, the use of projects as work procedure and evaluation not only makes it possible to articulate different statistical concepts, but also helps to establish a relationship between the statistical content of the discipline and the student's needs and interests. The results indicate that Statistics teaching requires the professor to understand the area to which it is applied. It was also observed that statistical procedures and techniques, when associated with investigation practice and research, are more significant to the future professional.

Poster 5

ASSESSING UNDERSTANDING OF THE CONCEPT OF INTERACTION IN ANALYSIS OF VARIANCE

GREEN, Kathy E.
University of Denver
USA

Students have difficulty understanding the concept of interaction in analysis of variance, implications of the presence of a significant interaction for interpretation of main effects, and appropriate follow-up procedures. While grasping computational procedures and how to get software to generate the appropriate terms, interpretation and communication of results poses a challenge. In this paper exercises for teaching interpretation of interaction are presented. The context was an anova course designed for doctoral students in a college of education. These students are typically interested in substantive research areas such as counseling or educational administration, so the course is applied in nature. The approach taken to teaching interaction was scaffolding or layering of skills. Students first listened to explanations and examples of what interaction is and answered multiple choice questions oriented to comprehension and application outside of class. They then worked in small groups in class to calculate interaction terms both by hand and using statistical software. Next students wrote both technical summaries of results suitable for submission to a journal and one-paragraph "press releases," both of which were critiqued by the course instructor and graduate teaching assistant. These exercises were standard across students and were highly structured. Students then received different data sets and were asked to repeat the analysis, technical, and brief write-up of results for the new data as a homework exercise. The "press releases" were the basis of 5-minute in-class presentations done to encourage verbal communication of results. After the presentation, classmates were given a 3-item quiz about their understanding of the results just presented. The quiz responses were used as feedback to the presenter about the effectiveness of their communication. Successes and failures of this approach are discussed as are thoughts about future directions in teaching about interaction.

Poster 6
WE THINK THEY HAVE LEARNED: ARE WE RIGHT?

MAGALHÃES, Marcos Nascimento
University of Sao Paulo
Brazil

The objective of this paper is to report results of a study performed at University of Sao Paulo about student learning in Statistics courses attended by students of the Mathematics and Statistics Institute of the University of Sao Paulo, Brazil. The study included students of the following careers: Bachelor in Computer Science, Mathematics, Applied Mathematics and Statistics and, also, students of Mathematics Education. All the students had had two semesters' courses focusing on topics such as descriptive statistics, probability, discrete and continuous random variables, estimation and hypothesis tests. All the students who were approved in these courses were asked to answer, in a volunteer basis, a questionnaire with a test composed of 50 true-false questions. The set of questions included graph analysis, frequency table, measures of position and dispersion, probability, binomial and normal distributions, point and interval estimation and hypothesis tests. During the test, they could not use books as support. Also, they could not use computer or hand calculator, but they had no time limit to answer the test. Data were collected on March 2005, 2006 and 2007, after the summer vacation and about 3 months after the end of the courses. This period helped us to identify the knowledge students had really learned and could use in the future. Based on the data collected, we performed a descriptive analysis identifying questions and subjects with better and worse scores. The average scores were 70% in 2005, 69% in 2006 and 76% in 2007. Besides the increase in 2007, these scores indicating a poor result since the random answer would produce 50%. Descriptive Statistics was the subject with better performance and Inference were the one with the worse. We also compared careers and evaluated the effect of the motivation toward the course. In these comparisons, we considered average scores in four moments of the students' context: admission at the university, statistics courses I and II and the score in our test.

Poster 7
ASSESSING STUDENT LEARNING IN STATISTICS AT THE "UNIVERSITY OF NATURAL RESOURCES AND APPLIED LIFE SCIENCES

MODER, Karl
University of Natural Resources and Applied Life Sciences
Austria

Statistical teaching at the "University of Natural Resources and Applied Life Sciences" in Vienna is based on 3 parts. Students have to complete 3 different tasks in SAS, SPSS or R, further they have to complete 10 to 12 online examples (depending on the branch of study) and at last they have to pass a written theoretical test consisting of 2 scopes. Scope 1 concerns statistical basics. In scope 2 they have to recognize which method to use for a certain statistical problem. Online examples as well as SAS, SPSS, R tasks can be done at home. Each student gets datasets of his own. These 10 to 12 online examples cover parametric tasks (like t-test, ANOVA, regression analysis, confidence intervals…) as well as non parametric ones (like contingence tables, Kolmogorov-Smirnov-test, Kruskal-Wallis-test). Datasets and according solutions are created by means of a FORTRAN-program. These data are inserted into a MySQL-table. A corresponding PHP-program produces an online mask for gaining these data, enter solutions and control results. A time window of 7 to 14 days each allows students to fulfil their tasks. At least 50% to 75% of the maximal possible sum of points has to be gained as a prerequisite for the written test. Another possibility of the PHP-program allows students to train recognition of the method to use for randomly chosen data with regard to the written test. Access to the program is based on surname, first name and registration number. A registration number from 1 to 99 allows to practice without any time restriction.

Poster 8
DESIGNING A RESPOSITORY OF TEST QUIZES FOR SELF-ASSESSMENT STATISTICAL COMPETENCES

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Writing effective exam questions is always a matter of teaching and learning process. We need effective questions in order to assess statistical capabilities: statistical literacy, statistical reasoning and statistical thinking. A Learning Management System (LMS) allow us to use the technology to support a repository of test quizzes for self-assessment. They may be used as Learning Objects (LO) for learning and assessment. We have established three levels of competences: literacy, reasoning and thinking and so we have used Bloom's Taxonomy adapted to guide the objectives of the quizzes. The adaptation of the Bloom's Taxonomy has been considered as follows: Levels 1-2 for literacy, levels 3-4 for reasoning, levels 5-6 for thinking. Using a virtual support we have proposed our students to write questions of the three different competence levels. Afterward assessment of the quizzes from students is performed. We use rubrics in both guiding students for constructing good quizzes and checking different aspects of the question to be a good one for the required level of competence. The student is the maker of the questions and the teacher supervise and assess the final product. Once the question is ready it is added to the repository for re-use in future self-assessment to a whole group of students. Through a constructive activity we get our data base of quizzes to be increased. They may be gather together as Learning Objects. The activity itself is a method of assessing about literacy, reasoning and thinking and so the competences that are involved. Students get feedback about their learning and teacher get feedback about student weaknesses.

Poster 9
ASSESSMENT OF THE USE OF ALEA'S ONLINE RESOURCES IN INTRODUCTORY STATISTICAL LEARNING

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Creating experimental and learning environments based on ICT, namely through the analysis of real data is an important way to improve the statistical and technological literacy. By means of ALEA (Local Action of Applied Statistics – www.alea.pt), different instruments were available to provide support in the teaching of Statistics to Primary and Secondary School students and teachers.

ALEA's Challenges and *Activaleas* are two resources with great use by teachers and students. *ALEA's Challenges* is a Portuguese language contest containing everyday problems based on daily news, oriented towards the Primary and Secondary students aiming to increase the reading ability of tables and graphs. *Activaleas* are learning-by-doing assignments containing tasks, comments and self-test questions in order to systematize the basic statistical concepts in the classroom.

This paper presents the first results of a survey where we expose the manner by which these two resources have been used in Primary and Secondary School by teachers and students. Some of the results allow us to answer the following questions:

- What is the impact of the news coming from journals and magazines, containing tables and graphs, in the comprehension of the basic statistical concepts; what are the students' most favourite themes that can be used to teach statistics?
- Do teachers feel that they have enough classroom conditions to use experiments and resources in order to systematize the basic statistical concepts?
- How can we measure the student's motivation to learn statistics?
- What is the role of teaching based on experiments in statistics?

At the end, we also provide some suggestions to promote and diversify the implementation of similar and complementary on line resources. It is proved that collaborative work in the classroom is essential to promote statistical literacy worldwide.

Poster 10
A DEMONSTRATION OF TRAINING AND ASSESSMENT MATERIALS BUILT WITH THE ISLP

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The tools we build to assess statistical literacy depend to a large extent on what model of statistical literacy we are inclined to believe in and what is our constituency. This poster is intended to illustrate how the resources compiled by the ISLP can be used for assessing statistical literacy. The poster shows three things: (a) examples of questionnaires to assess statistical literacy under different models and for different constituencies; (b) examples of the materials (brochures) that we have created to guide visitors in the use of the resources in the ISLP depending on their statistical literacy needs and (c) how to use the the wiki in the ISLP.

Poster 11
ASSESSING THE KNOWLEDGE OF FUTURE MIDDLE SCHOOL TEACHERS IN STATISTICS BY LESSON DESIGN

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The assessment of future teachers of statistics at the middle school level is gaining importance as new textbooks and courses are being developed to target this specific population. The assessment of future teachers is different than the assessment of other undergraduates taking statistics. As the statistical content is linked to the job of teaching statistics, so are the assessment activities. In this paper, I illustrate an assessment project conducted in a class for future middle school teachers in statistics. The project consisted of designing and presenting a lesson that addressed a statistical concept taught in middle school following the Japanese Lesson Study model. Future teachers were asked to identify the big ideas covered, its connections to previous and future content by aligning the lesson to state, national standards, and the GAISE recommendations, make predictions about students misunderstandings based on readings about statistics education research, propose activities or procedures on how to teach the concept, and create an evaluation plan. Future teachers wrote and presented the lesson in pairs to their peers and the professor. After each presentation a reflection, in the form of a discussion, followed. Future teachers refined their lessons based on the comments of others and prepared a final lesson design. At the end of the semester, the future teachers voted for the "best" lesson and implemented the lesson at a local middle school (5^{th} graders). Rubrics were developed to assess both lesson design and presentations.

Poster 12
ASSESSING THE INCLUSION OF BIOSTATISTICS IN SCHOOLS OF DENTISTRY IN BRAZIL

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The National Institute of Study and Research of the Ministry of Education in Brazil states that there are 169 Schools of Dentistry in this country in 2006. It is known that their curriculum doesn't always cover Biostatistics. At the School of Dentistry of Araçatuba, Unesp, Brazil, this subject is included in the course with 90 hours all over the year. The practice classes account for 2/3 of the hours by using computer. An interrelationship among others professors has been developed for some years using database of different dental fields. Twelve to 16 undergraduates students per year are trainees, and they do research on applied-statistics and some of then present their work in scientific events and carry out attendance activity applying knowledge of "statistics and health" in 12 year-old students of public school. The aim of this research is to get acquainted the teaching of the Biostatics in the other 168 school of dentistry in Brazil to. The methodology applied was the search for the sites of 168 schools on the internet and the sending of the questionnaire to all the coordinators of the courses by e-mail and/or fax. By the Internet, only 86 out of a168 schools have cover the same syllabus on the sites. Biostatistics is presented in 48 schools. As for the result of 74 questionnaires answered, 45 stated the inclusion of Biostatistics in their curriculum and 29 stated non-inclusion of it. In 11 colleges Biostatistics notions are taught inside others subjects. Only in 4 schools Biostatistics is taught all over the year in "61 to 90" hours and; in 2 the Biostatistics is not mandatory; in 28 schools, during a semester and 23 of these in "31 to 60" hours and 5 of these in less than 30 hours. So, Biostatistics is covered in 33 school of dentistry, including the School of Dentistry of Araçatuba, Unesp. Only 8 schools have trainees in Biostatistics and 21 schools make use of the computer to teach it. The conclusion is that the teaching of Biostatistics must be incentivated in all the schools of dentistry in Brazil using our successful experience.

Poster 13
THE IMPACT OF ONLINE TESTING ON STUDENT LEARNING OUTCOMES

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In 2006, we introduced a system for automated online exam creation and correction at ICOTS-7 in Salvador, Brazil. The system creates exams based on randomly generated data and SQL queries from a database of question templates. This combination ensures unique tests for each student. In this paper, we wish to present some of the impacts on student learning outcomes as a result of employing an automated testing system. Specifically, we show that via the use of such technology, exams may become a tool for informing decisions about student learning and lecture presentation. Thus, rather than being constrained by a traditional testing paradigm, a continuous assessment process is possible with the quick turnaround provided by an automated system.

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