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This issue contains information on the Advanced Placement statistics course being developed for high school students in the United States and an article on applying cognitive theories of learning to short courses in statistics. A reminder on ICOTS 5 is included.

ADVANCED PLACEMENT STATISTICS - A NEW OPPORTUNITY FOR SECONDARY SCHOOL STUDENTS

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The Advanced Placement (AP) Program, sponsored by the College Board, offers secondary school students the opportunity to pursue and receive college credit for college level courses. Through the Advanced Placement International Diploma (APID) successful AP candidates may have their achievements certified and recognized at universities throughout the world.

In May 1997, the first AP examination in statistics will be given. This offers a new opportunity for students to include statistics in their secondary school careers. The AP Statistics course has been under development since 1994. The course is conceptually rather than techniques oriented and covers topics in four major areas: exploratory analysis, planning a study, probability, and statistical inference. Within each area the topics emphasize statistical thinking and minimize computational procedures. The instructional emphasis is toward a mode of teaching that engages students in constructing their own knowledge. Recommended components of the course include the use of technology, projects and laboratories, cooperative group problem-solving, and writing as a part of concept-oriented instruction and assessment.

The AP Statistics examination consists of a 90 minute section of 35 multiple-choice questions and a 90 minute section of free response questions. The two sections are equally weighted. The free response section asks the student to answer 5 or 6 open-ended questions and to complete an investigative task that involves more extended reasoning. Students are expected to be familiar with standard computer output and to be able to extract necessary information from it to answer questions on the exam. They are also expected to bring a graphing calculator to the exam and to be familiar with its use.

There are two publications available that describe the AP Statistics course and examination in more detail, the Course Description, (IN-201619), and the Teacher's Guide. The Course Description includes a course outline, a discussion of the AP Statistics examination including sample questions, and statements on the use of technology and instructional emphasis. The Teacher's Guide gives additional information designed to help teachers organize and prepare to teach an AP Statistics course. It includes sample course outlines,

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examples of examination questions and their scoring rubrics, models for statistical analysis, and a particularly valuable list of resources for teaching the course. These include suggestions for textbooks, reference books and supplementary texts, background reading, journals, videotapes, statistical software, and website addresses that offer opportunities for sharing ideas and finding good data for statistical investigations. Both these publications are available from:

Advanced Placement Program, P.O. Box 6670, Princeton, NJ 08541-6670; phone (609) 771 7243.

APPLICATIONS OF COGNITIVE THEORIES OF LEARNING IN A SHORT COURSE IN STATISTICS - a model of teaching with introductory questions

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Summary

Research in the area of education is reviewed and the results have been applied to the teaching of college-level short statistics courses. The argument is made that statistics educators need to determine what it is they really want students to learn, to modify their teaching according to suggestions from the research literature, and to use assessment to determine if their teaching is effective and if students are developing statistical understanding and competence. Cognitive theories have been studied and the principals of problem based learning, reflective learning and progressive learning have been applied.

Introduction

Many students have the experience that courses in theoretical subjects in education are sometimes difficult and too abstract. Many students cannot see the relationship between the theoretical knowledge and the practical side of education. They don't see the importance of statistics and the possibilities of use in the education and later in work. The aim of

courses in statistics is to teach understanding of basic statistics and give the students a consciousness of statistical methods and a statistical approach.

My idea is that a course in statistics with good questions/problems is a good way of teaching even common mathematical thinking, specially for those people who have negative experiences of mathematics from school. The educational literature describes alternative forms of working which can be used in courses of statistics. I have from these ideas worked out a teaching model for short courses in statistics, which I have tested, evaluated and theoretically established.

From the Literature

In the literature I have looked for educational methods which imply activity, dialogue and communication. This is according to my opinion the condition for the self directed "deep" learning. Still much teaching at our schools and universities is "fact transference".

Barnes (1975) states that talks (discussions) and talks in groups are an important part in all education. Entwistle and Marton (1986) say that there is just now a large gap between the situations which have been researched and the situations which meet the teacher and the students. We need detailed analyses from individual institutions and much experimentation in the classroom. Research results must be applied in teaching situations.

Egidius (1991) emphasizes that it is important to have a pedagogical basic view even if one uses different forms of working with students. He introduces the method of problem based learning. The three aims of problem based learning are to start from a framing of the question/problem, to encourage self directed learning and to cooperate in groups. Cook (1992) and his colleagues work with a teaching model named "reflective learning". According to Cook this method is a development of PBL. Gibbs (1994) says that four corner-stones are important in all learning: motivation, activity, interaction and structures. One must make learning situations with these components.

Theories Applied in the Classroom

A good way to formulate questions/problems in the classroom is to let the students in groups of 2 or 3 discuss for some minutes and then ask every group about ideas and questions. After this introduction the teacher can give information through a short lecture. Every new element in the course should be introduced in this way: short student discussions and short lectures. Much work on finding good questions to start the discussion has been done already. Examples include:

What is statistics?

What knowledge do you need?

How can you design a survey and how can you use the statistical theory?

How do people like their job?

What can you say about all people in Sweden from a sample?

What sample size do you need?

How can you describe the difference in precision for different samples?

Can growth rescue the world?

How many people can live on earth?

Random events and probability - what are the key words?

How can you get a sample with good representation of a population?

Results and Conclusions

The teaching model has been studied in the classroom. The result of the dialogue in the classroom was observed and registered by a particular observer. The students asked a lot of questions and expressed their need of knowledge of basic statistics, as mean, standard deviation, tables, diagrams, time series and regression, prognosis methods, demography, probability theory, inference and survey methods. The examination was made in the form of a group examination. Even in this examination situation there was a dialogue and "probing/sounding" talk.

In the course evaluation the students expressed their experiences of the teaching model and reported that they had gotten good comprehension of the subject. The experiences with this teaching model are that it becomes a fun and meaningful course, where it is easy to introduce even abstract concepts. The "sounding"/asking learning situation creates possibilities for a discussion which becomes deep and the results will be "deep" learning. The teaching/learning became a dialogue with many questions and meaningful learning.

Computer Aid

Many abstract subjects can be shown more concretely with the computer. With SPSS, a minisurvey was made in the classroom. One of the questions was: How do you like your studies? A lot of questions were to be summarized with frequency tables, cross tables, descriptive statistics and charts and a small report finished the task. EXCEL offers a lot of possibilities to learn statistics. Exercises which are first prepared and calculated in the class room can be completed or extended with the computer.

Make a Project

To connect theory to practice it is a good idea to have students conduct a survey. The question for the project was on one occasion: WHAT IS THE MARKET FOR AN ECONOMIST? This task gave possibilities to follow the steps in a statistical research:

- aim
- population
- sample (OSU and size)
- defining the problem
- formulate questionnaire
- computer calculation
- report with analysis

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DO YOU HAVE SOMETHING TO OFFER?

Both of the articles in this issue have something to say about modern theories of learning as applied to statistics. The AP program seeks to involve students in the discovery process and the Swedish program emphasizes problem-based learning. We would be happy to print other articles that deal with these and similar issues. For that matter, we would be happy to consider any contributions in the area of statistics education that you think appropriate for this newsletter. Please send your contribution to the editor:

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ICOTS-5 IS APPROACHING RAPIDLY!

Have you made plans to attend ICOTS-5 in Singapore, June 21-26, 1998. It is not that far away. The Program Committee is still accepting papers, but please submit your abstract as soon as possible as slots are rapidly filling up. A detailed list of members of the program Committee and the topics for the meeting was provided in the Spring, 1997 *IASE Matters*. For general information, please contact the web site at

www.nie.ac.sg:8000/~wwwmathlicots.html

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We hope to see many of you in Singapore in 1998.