

EXPERIENCES WITH INTERNATIONAL WEB-BASED INTRODUCTORY LONG-DISTANCE STATISTICS COURSES

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Abstract

Throughout the year 2004, Utah State University offered three long-distance introductory statistics courses (Stat 2000) for students in its International Program in Hong Kong. These courses had the main instructor in the USA, a local instructor in Hong Kong, and were based on the electronic textbook CyberStats. Students had to work fully electronically — from homework submissions to examinations. In this paper, we report our experiences with these courses, including everyday problems and their possible solutions. Results of surveys conducted towards the end of the three courses will be presented as well.

1. Introduction

Throughout the year 2004, the Utah State University International Program offered three sessions of “Introduction to Statistical Methods” (Stat 2000) as a long-distance course for Utah State University students enrolled in Hong Kong. The Spring 2004 session lasted 15 weeks (1/12/04 through 4/19/04) and was attended by 60 students, the Summer/1 2004 session lasted 12 weeks (2/23/04 through 5/10/04) and was attended by 30 students, and the Summer/2 2004 session lasted 15 weeks (4/26/04 through 8/2/04) and was attended by 89 students. The three sessions were based on the electronic textbook CyberStats.

In this paper we describe our experiences with these three sessions. The setup in the United States is described in Section 2. This section also provides a brief overview of CyberStats, an electronic textbook used in all three sessions. The setup in Hong Kong is described in Section 3. A summary of student surveys is given in Section 4. We finish with a discussion and recommendations for future similar courses in Section 5.

2. The United States Setup

The three sessions of “Introduction to Statistical Methods” (Stat 2000) had one main instructor, residing at Utah State University in the United States, and one local instructor, residing in Hong Kong. In this section, we discuss the setup in the United States. More details on the setup in Hong Kong are given in the next section. The course Web pages can still be accessed:

- Spring 2004 session:
http://www.math.usu.edu/~symanzik/teaching/2004_stat2000/stat2000_index.html
- Summer/1 2004 session:
http://www.math.usu.edu/~symanzik/teaching/2004_stat2000_summer/stat2000_index.html
- Summer/2 2004 session:
http://www.math.usu.edu/~symanzik/teaching/2004_stat2000_summer_2/stat2000_index.html

2.1. The Course Structure

The three sessions of Stat 2000 were fully based on the electronic textbook CyberStats (<http://www.cyberk.com>). To our best knowledge, these sessions were the first where CyberStats was used outside North America. CyberStats is a product of CyberGnostics, Inc. The first version of CyberStats appeared around 1996 and was released to interested individuals free of charge exclusively for test purposes. In Fall 2001, CyberStats Version 2.0 was available as a commercial product. CyberStats is a fully Web-based package and access is granted for about an academic term upon registration and a payment of \$33 per individual user. Recently, CyberStats has been purchased by Thomson Publishing.

A review of CyberStats Version 2.0 can be found in Dear (2001). Comparisons of CyberStats with two other popular teachware packages, ActivStats and MM*Stat, can be found in Symanzik & Vukasinovic (2002) and Symanzik & Vukasinovic (2003). A

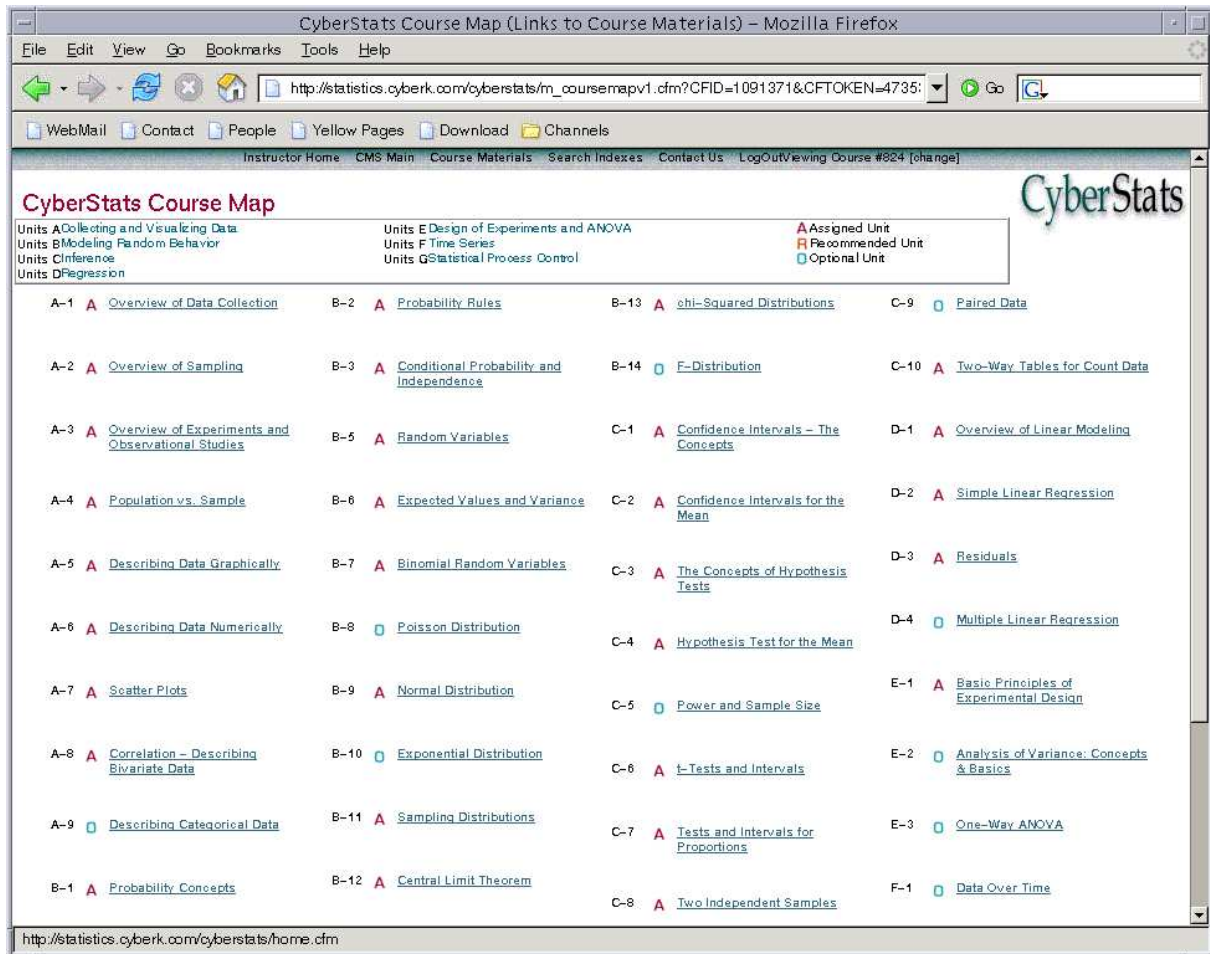


Figure 1: CyberStats Course Map with assigned (A) and optional (O) units.

description of a “hybrid” course that makes use of CyberStats can be found in Utts, Sommer, Acredolo, Maher & Matthews (2003). A recent review of six online instructional materials, including CyberStats, can be found in Larreamendy-Joerns, Leinhardt & Corredor (2005).

In CyberStats, the course content is divided into seven sets of units: collecting and visualizing data, modeling random behavior, inference, regression, design of experiments and ANOVA, time series, and statistical process control. Each set of units consists of one to fourteen units (see Figure 1). Units resemble chapters in traditional printed textbooks. Each unit in CyberStats begins with a “Summary”, followed by a set of motivational questions related to the topic (“Think first”). The actual chapter is presented in form of “Three Keys”: “Basics”, where the basic concepts are presented; “Uses”, where a student has a chance to work through a set of examples and exercises; and “Warnings”, where potential dangers of wrongly used statistical concepts are dis-

cussed. Each of these three keys is accompanied by plenty of examples and exercises and followed by a self-assessment test. In each exercise set, a student can submit the answers to the system, which are automatically recorded on the CyberStats server and can be accessed by the instructor and the student.

In each of our three sessions, we discussed about 30 of the CyberStats units, i.e., about two units per week in the two 15-week sessions and two to three units per week in the 12-week session. Units discussed in the 15-week sessions were A1–A8, B1–B3, B5–B7, B9, B11–B13, C1–C4, C6–C8, C10, D1–D3, and E1 (see Figure 1). Units D3 and E1 were omitted from the 12-week session.

The students had to work fully electronically using CyberStats. No printed textbook was required and none of the students made use of the option to additionally acquire a printed version of the CyberStats main content for an additional \$5. Homework submissions and grading was done electronically within CyberStats and is discussed in more details in Sec-

tion 3.2. Exams were fully given and graded in CyberStats as well, as further discussed in Section 2.2 below. Communication between the students in Hong Kong and the main instructor in the United States took place via the CyberStats message board and via e-mails.

2.2. Electronic Exams and Their Grading

The electronic exams in CyberStats consisted of two midterms and one final exam in the Spring 2004 session and one midterm and one final exam in the Summer/1 2004 and Summer/2 2004 sessions. Students took the exams in an electronic classroom in the Institute of Advanced Learning (<http://www.in-learning.edu.hk>) in Hong Kong. While all students of the Summer/1 2004 session could take the exams simultaneously, students from the Spring 2004 and Summer/2 2004 sessions took the exams consecutively in two or three groups. Students from a later group were asked to meet 15 minutes prior to the scheduled start of their exam in a different classroom to minimize the possibility of direct verbal communication.

Exams were a mixture between multiple-choice questions with one correct answer and essay-type questions that required a text-based answer. The latter type of questions was originally not supported by CyberStats. However, the CyberStats technical support, in particular, Ms. Palyne Gaenir, extended the existing exam structure such that these questions could be asked as well in specially customized exams.

Students had full access to CyberStats and all its features during the exams. Answers to multiple-choice questions had to be marked via toggle buttons and text-based answers had to be filled in into text fields. To ensure the recording of student answers on the CyberStats server, students explicitly had to click on a "Submit" button after each answer. Answers that were not confirmed by "Submit" were lost in case the Web browser window with the answers was closed or refreshed as well as in case of any computer crashes. Students were frequently reminded that they had to click on "Submit" for each answer. Throughout the three sessions and seven exams, it appeared that two or three students lost a major part of their answers either due to a Web browser failure or by unintentionally closing the window with their answers before clicking on "Submit". In such cases, another exam was used to adjust the overall grade for these students.

Students could access the exam questions only during their assigned exam period via an additional password that was provided at the start of the exam.

The question order was randomized for each student, but all students within each of the three sessions had identical exam questions.

About one week before each exam, students were provided with sample exams and solutions. Old exams and their solutions were later posted on the course Web pages, thus providing a growing pool of training material for students in the later sessions.

Grading of the exams was done via a html Web page particularly developed for these sessions by Ms. Palyne Gaenir. Multiple-choice questions could be graded automatically by providing the correct answer key. Questions that required a text-based answer had grading forms where points and personal comments could be added. Grading was done by showing all answers to a question at the same time, i.e., all n_1 answers to question 1, then all n_2 answers to question 2, etc. Usually, the number of answers n_i for each question i was bigger than the number of participating students because all answers, including duplicated ones, were recorded. However, only the last submitted answer was used to determine the students' grades.

The electronic recording of students answers, including answering times and duplicated answers, provided some interesting data to analyze. A preliminary analysis of this data can be found in Symanzik, Erbacher, Gaenir, Vukasinovic & Wun (2004). An open future research question is: In which way do students change their answers, i.e., more frequently from incorrect to correct for multiple-choice questions or vice versa, and how many points are gained or lost by modifying or replacing a text-based answer?

2.3. Problems and their Solutions

One of the main problems in the Spring 2004 session was cheating in the final exam. Eventually, seven students were given an "F" degree because they had fully identical answers to several of the questions with text-based answers. This often included exactly matching typos, unusual punctuation, and incorrect grammar. The cheating first became apparent when several of the students involved had similar answers that did not even match the question.

As an example, below are the answers to question 39 (in the internal ordering) for two of the students in the final exam in the Spring 2004 session:

ID 1244x:

[ServerTime Apr-21-2004 10:46:52 PM]

there has three outliers , and the data is fairly symmetric

ID 1257x:

[ServerTime Apr-21-2004 10:54:14 PM]
there are no outliers. The boxplot shows
that there is fairly symmetric.

ID 1257x:

[ServerTime Apr-21-2004 11:18:37 PM]
there has three outliers , and the data is
fairly symmetric

ID 1257x:

[ServerTime Apr-21-2004 11:20:25 PM]
there has three outliers , and the data is
fairly symmetric

Note that the student with ID 1257x initially stated that there are no outliers. The second submission of this student was exactly matching the answer from the student with ID 1244x, including the unusual space before the “,” and now stating that there are three outliers. The third submission of this student was another click on the “Submit” button to assure that the answer got recorded on the CyberStats server. In fact, many students resubmitted their final answers to make sure they got correctly recorded.

We have no answer how the students exactly cheated, but we strongly assume that they either were able to communicate to each other via e-mail or by file sharing, thus having exactly matching answers. However, given that several of the matching answers did not relate at all to the question shows that students only had limited abilities to communicate with each other. As a reminder, each student had a different question order, so answers apparently got shared without communicating the full underlying question.

In the Summer/1 2004 and Summer/2 2004 sessions, we positioned additional proctors in the back of the classroom who should prevent that students use any software for electronic communications. No further cheating was observed in these sessions.

It should be noted that cheating via electronic devices is not limited to this long-distance course. The Utah State University Administration informed instructors early in 2005 that another reported instance of cheating in another course involved the use of camera phones where one student photographed an image of his/her paper and sent it to another student in the same room. As a consequence, cell phones and other electronic devices now have to be turned off and placed inside bags during exams. A violation of this policy makes it possible for instructors to immediately assign a score of zero on that exam, possibly followed by further disciplinary ac-

tion. However, this policy does not immediately apply to a long-distance course where all the exam questions and statistical tools and calculators necessary to answer the questions are accessible on the Web. The continued use of human proctors is one possible solution. It would be even better if the sending/receiving of e-mails and file sharing could be easily suppressed during the exam periods or if at least some electronic monitoring would take place where each usage of such a program is reported. The solution to provide (slightly) different questions to each student may not be very effective when exams are created and graded manually. However, this may become an option when slightly different questions and their answers could be created automatically.

The other problem we observed in these sessions was that students could not be motivated to participate in any discussion via the message board. This may have been due to shyness or language problems (none of the students spoke English as first language) — or simply all questions were answered during the weekly meetings with their local instructor in Hong Kong or further direct communication with the local instructor. In any case, we do not have any solution at this point how to better motivate students to participate in discussions via the message board.

3. The Hong Kong Setup

In this section, we focus on the weekly meetings in Hong Kong and the handling of electronic homework submissions.

3.1. The Weekly Meetings

All sessions met once per week for a three hour lecture with their local instructor in a computer lab in the Institute of Advanced Learning in Hong Kong. During the lectures, the time was approximately broken down as follows: 10 minutes for setting up the computers and letting the students settle down and login to CyberStats; 75 minutes of lecture time, followed by a 5 minutes break; and another 75 minutes of lecture time, followed by 15 minutes for questions and answers.

During the lecture time, the local instructor followed the material in each CyberStats unit and discussed the main ideas with the students. In each unit, the local instructor worked with the students through the “Basics”, “Uses”, “Warnings”, and examples. For the build-in exercises, the students were told to do them on their own and ask the local instructor if they encountered any problems. For the homework assignments, the local instructor briefly went through the questions with the students to give

them some basic ideas and guidelines how to answer these questions.

When a CyberStats unit required the usage of the CyberStats calculators (such as the normal probability or binomial probability calculators) or the integrated statistics package WebStat (West, Ogden & Rossini 1998, West & Ogden 1998), their usage was demonstrated to the students and they were asked to try them themselves in class. In this process, the local instructor tried to ensure that everyone present knew how to use the calculators or WebStat for the relevant content in the CyberStats unit currently being discussed.

Since most calculation work could be done by either the CyberStats calculators or WebStat, the local instructor seldom used the black board. The rare cases where the black board was used were for the computation of standard deviations of discrete probability distributions and the explanation how to use the Chi-squared distribution for dealing with problems related to variances.

Not many students prepared new units before the weekly meetings. Since the concepts and methods in each unit were not independent of each other, in each lecture, the local instructor carefully had to go through the necessary details to make sure that the students could follow the entire lecture content well.

In the questions and answers part of the lecture, the students had a chance to further practice with the calculators and with WebStat. Some of the more advanced students used this time to finish their homework assignments. Other students used this part of the lecture for questions about the previous homework. Detailed answers to homework questions only were provided upon request. The reason for not providing detailed answers to all homework questions was that this course will be offered in the future, but the pool of available homework questions in each CyberStats unit is somewhat limited. If detailed answers had been handed out, this considerably would have increased the risk of passing on the answers from the students in one session to the students in one of the next sessions.

There was no great difference between the overall student attendance for the three sessions, but there was an interesting trend for all of them. For the first few lectures, the student attendance was over 90%, but it decreased gradually to about 70% — except for the last meeting before each exam. Those meetings usually were used for the discussion of the sample exams, and attendance was close to 100%. A possible reason for the somewhat lower attendance of about 70% during the later parts of the semesters was that the students may have thought that the ex-

ams were “open-book” and “open-notes”, and thus, some of them may have thought that it may not be necessary to attend the regular lectures. It appears to be a common phenomenon for courses that have such “open-book” exams that some of the students think they do not need to memorize anything because they could “find” the answers in the book (or on the Web) during the exam. Obviously, this usually is not the case.

In a computer classroom, it was hard to distinguish students who

were really following the lecture from those who spent time on other activities or even distracted their classmates. The first reason was that everyone had a monitor on the desk, so it separated the local instructor’s eyesight from many of the students and, therefore, the students were much more “relaxed”. Besides, since the students had Internet access, they could easily surf the Web and do anything they liked to do other than statistics.

Questions the students asked by e-mail during the week were mainly about the submission date of the homework assignments and the arrangements about the exams. Questions about the statistical concepts and CyberStats were asked in the question and answer parts during the lectures. The reason might be that it was more difficult for students to ask such types of questions through email, so students chose to ask such questions during the lectures. The statistical concepts questions could be addressed easily in the classroom. The CyberStats questions, especially about the use of WebStat, sometimes required more time to answer (or to demonstrate) because some of the students were not familiar with such kind of software. But generally, this was not a big problem as WebStat was quite user-friendly.

Often, the classes held in the same classroom before the Stat 2000 sessions did not require the computers. Then, usually, the monitors were packed away. Therefore, during the beginning of the lectures, the students needed time to set up the monitors for use in the Stat 2000 lectures. Even though the monitors were slim ones, about 10 minutes were needed in the beginning of the lectures to fully settle down.

3.2. Electronic Homework Submissions and Their Grading

Almost all students submitted their homework answers directly in CyberStats. The few students who did not use CyberStats for homework submissions submitted their homework answers on paper. They thought that it is “safer” if the local instructor received their answers by hand.

About 60% to 70% of the homework answers were submitted on time. Due to the fact that several students were only studying on a part-time basis, a hard deadline may have been too harsh for them. Besides, due to tests and exams in other courses, students who were not too well organized often requested to postpone the submission deadline. Usually, those students submitted their homework answers within two weeks after the original deadline. There was one particular student in these sessions who did not register for CyberStats until the midterm. This student therefore submitted the homework answers quite late. A penalty was given in this particular case to keep the fairness. However, the deadline for the final submission of the homework answers was set hard, i.e., to the day before the final exam. The purpose of assigning homework was to encourage the students to learn by working on homework problems. Therefore, there was no point in allowing the students to submit their homework answers after the final exam.

Homework answers could be graded directly in CyberStats. According to the local instructor in Hong Kong who was dealing with the homework grading, the online grading of homeworks was very convenient.

3.3. Problems and their Solutions

Main problems regarding the use of CyberStats in the classroom were mostly of technical nature. During the lectures, there were two major types of computer problems. The first one was that the download time of a Web page or any application in CyberStats was different for each student. Therefore, it was necessary to wait for everyone to ensure that every student knew what the local instructor was talking about. Besides, for the applications in CyberStats, the installation of Java was required. However, due to security reasons (maybe to prevent the computers from becoming infected by viruses), some computers were blocked to Java. Students sitting in front of such a computer had to join students on another computer and only had a chance to try what they learned in class on their own computers at home.

About five to six computers in the electronic classroom had these Java problems and these were usually the same ones each week. Therefore, before the exams, the number of fully operational computers was first counted and then the appropriate number of students was assigned to each of the exam groups. Exams often had to be scheduled at times other than the regular weekly meeting times to allow back-to-back exams, as described in Section 2.2. Two computers were not assigned to any student

before each of the exams and were kept as possible substitutes in case any of the computers assigned to a student did not work during an exam. In case a student really had to switch computers, additional time (usually 15 minutes) was allowed to compensate for the necessary switch from one computer to another and the need to re-open many windows and the CyberStats calculators. It was never determined why those Java problems occurred only on these five or six computers. The technical support at the Institute of Advanced Learning unfortunately was not able to provide much help.

During exams, there were a few more problems. Because the exams were time-restricted, some students complained that they were running out of time due to the slow downloading rates. However, although this problem certainly exists, it appears that some students also tried to use this as an excuse to obtain some additional time for their exams.

One possible solution to this problem is to speed up the downloading times, e.g., via CyberStats mirror sites in different continents. Moreover, a better site map that would allow the students to find information they are looking for more easily would be beneficial.

4. Evaluation of Student Surveys

In each session, at the end of the semester after the final exam (but before final exam grades were made accessible for the students), the students were asked to fill out a survey designed by the main instructor to assess the overall quality of the course and instruction, students' opinion about CyberStats and exams, and demographics. The students were given several days to fill out the survey.

In the Spring 2004 session, the survey was voluntary and no extra credit was given to those students who found time to fill out the survey. In the Summer/1 2004 and Summer/2 2004 sessions, the survey was also voluntary, but the students were offered an extra credit of 20 points (toward the total score of 1000 points) if they submitted any answer. The purpose of giving extra credit was to motivate more students to fill out the survey and provide better feedback for the main instructor. As expected, many more students responded to the survey. In the Spring 2004 session only five out of 58 students who took the final exam responded, whereas in the two summer sessions almost all students provided their responses. 27 out of 27 students who took the final exam in the Summer/1 2004 session and 60 out of 81 students who took the final exam in the Summer/2 2004 session answered the survey. Eventually, it turned out that 59 out of the 69 students who

passed the Summer/2 2004 session had answered the survey while only 1 student who failed this session had answered the survey, meaning that there is a selection bias towards better students. While the surveys helped several students in the two summer sessions to improve their grade by a partial grade (such as from a “B” to a “B+”), no student was pushed from a “fail” to a “pass” grade in any session.

The surveys consisted of 23 questions, except for the Spring 2004 session, when the survey included two more questions related to an additional midterm exam. The questions in the survey could be divided into following types:

- General questions — aimed at assessing students’ opinion regarding the overall quality of the course.
- Questions on instruction — meant to obtain students’ opinion about the quality of instruction, basically regarding the local instruction in Hong Kong during their weekly meetings.
- Questions about CyberStats — that asked students to rate their experiences with CyberStats and point out any particularly good or bad thing they encountered.
- Questions about exams — regarding the content, length, and level of difficulty of all (two or three) exams.
- Demographics questions — aimed at obtaining information about students, their age, gender, primary language, major, student status, and previous experience with statistics.

The survey was given in the same form as all other exams, i.e., the students had to click on a chosen answer and submit it to CyberStats. Therefore, the answers were not anonymous. Students were advised to skip questions they found inappropriate. Also, any answer, even N/A, was acceptable to obtain the extra credit.

4.1. Survey Results

As only five responses were obtained from the surveys given to students attending the Spring 2004 session, the analysis of the results will be focused on the two summer sessions.

In both summer sessions, the approximate gender ratio was 1:1. Only about one third of the students provided information about their age: the age of the students in the Summer/1 2004 session ranged from 21 to middle age, which was in agreement with their

student status: most of the students were active employees, studying while working. On the other hand, students taking the Summer/2 2004 session were mostly in their late teens and early twenties, and were full-time students. Native language for all students was Chinese, except for one student who indicated Japanese as native language. The majority of students majored in business, information technology, or were pursuing a degree in science. For the students of the Summer/2 2004 session, this course was the first statistics course, whereas most of the students in the Summer/1 2004 session had taken a business statistics or another introductory statistics course prior to this Stat 2000 course.

In general, the students were satisfied with the overall quality of the course and the instruction. In both sessions, about one third of the students rated this course as better than other distance learning courses they had taken before. When asked to point out what they would like to see improved regarding the instruction of this course and the way it was taught, several students complained about the shortage of computers and the fast pace of the local instructor.

Students’ opinions regarding CyberStats varied. In the Summer/1 2004 session, half of the students generally liked CyberStats, and only three students

thought that CyberStats was terrible. In the Summer/2 2004 session, 26 students found CyberStats terrible or were not happy about it; 17 students generally liked it. The favorite CyberStats features in both courses were interactives including the probability calculators and WebStat and the possibility to analyze data directly; the least popular CyberStats features were e-notes and the message board. When asked to identify any particular problem with CyberStats, some students complained about the slow download of interactives and a 30min time limit to do exercises.

Regarding exams, most students from the Summer/2 2004 session were fine with the length of the exams and difficulty level. However, about one quarter of the students from the Summer/1 2004 session said that the exams were too difficult and too long.

Differences in perception of exam difficulty between two sessions might be due to the fact that the Summer/1 2004 session was an evening course, held from 7pm to 10pm, so that the students had a full working day behind them and were already tired when taking the exams. For all students, favorite exam questions were multiple-choice questions, and the least-favorite questions were questions with text-based answers, with or without interactive tools, i.e., questions that required more time

and effort to answer.

5. Discussion and Recommendations

The overall experience with CyberStats was mostly positive — for the main instructor in the United States, the local instructor in Hong Kong, and the students in Hong Kong. CyberStats can be conveniently used, it is user-friendly, and its inter-actives, calculators, and WebStat provide an excellent aid for statistical calculations during the lectures and the exams. The technical support and information flow was also excellent while CyberStats was owned by CyberGnostics, Inc.

Some of the work that remains to be done is to link the student answer order in exams to the overall student performance. Do “A” students answer their exam questions in a different order than “C” students? Also, as pointed out earlier, the analysis of repeated/changed answers remains to be done.

Based on the overall positive experience in the past, we are currently, i.e., in the Fall 2005, using CyberStats again for another long-distance course for students in Hong Kong. However, since CyberStats is now owned by Thomson Publishing, some of the previously favorable conditions have considerably worsened. Thomson Publishing no longer supports the special exam features that allow a mixture of multiple-choice questions and questions with text-based answers within CyberStats — so we had to write a recent midterm with these two types of questions on paper and had to provide answer sheets that were mailed from Hong Kong to the United States. Also, the technical support provided by Thomson Publishing is limited to main hours according to US times — but this would not be of any help if problems occur during an exam taken during Hong Kong daytime, because of the 15 hours time difference. Some other features, such as the payment via International Money Orders, a potentially important feature for international students who do not necessarily own a credit card, also are no longer supported by Thomson Publishing. While all of this leaves the overall quality and functionality of CyberStats unaffected, instructors who want to use CyberStats for international long-distance courses should carefully consider how this might affect their course. Hopefully, Thomson Publishing will re-implement these features again in the future.

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