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STUDENT EVALUATION OF THE SOFTWARE IN THE AT&T TEACHING THEATER

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ABSTRACT

The AT&T Teaching Theater is a highly interactive, multimedia electronic classroom at the University of Maryland offering instructors many new and creative teaching opportunities. Although this technology may hold many exciting possibilities, it is important to not lose sight of the main objective of any teaching facility - the students. Therefore, the important questions are: "How do students rate the AT&T Teaching Theater? What are their opinions of the various types of software programs currently offered? Do they facilitate or interfere with the learning process?" This paper discusses the results from a survey of students who attended classes in the AT&T Teaching Theater, Fall semester, 1992. A comparison among the different types of software used by the various instructors is the focus for this evaluation. In particular, HyperCourseware, a program providing an "electronic infrastructure" for computer based education will be at the center of this comparison. HyperCourseware is a "work in progress" and is one of the few software packages used in the electronic classroom designed with the Teaching Theater in mind. The findings from this paper will be used to determine where improvements need to be made in order to benefit the students and to make the most of the technology offered in the AT&T Teaching Theater in the future.

INTRODUCTION

Creating better environments for students is a priority for most of today's educators. As we move into the future, it will become increasingly important for these educators to develop new methods for challenging and stimulating students academically . Technology provides a means for creating just such an atmosphere . By bringing together education and technology, the electronic classroom, attempts to offer a first step in the solution. An electronic classroom is a special room which provides computers for the students, networked and linked up with an instructor's computer. The electronic classroom offers students a certain potential of control over the learning process, as well as the ability to give input and feedback to the instructors. With the aid and convenience of technology, instructors now have the opportunity to provide more creative, flexible programs and to stimulate the students through a variety of media.

However, with such opportunities for advancement come problems. Since the electronic classroom is based on a computer network, all of the processing limitations often found in new systems, such as speed and reliability must be dealt with. In addition, for the classroom to really be used to potential, the instructors, currently, must spend more time in preparation for each lesson. What then, is the net loss or gain to the students? Do these problems interfere significantly with the learning process, or are they merely minor hassles which will eventually be eliminated and will allow the student to fully enjoy the benefits of the electronic classroom?

This paper uses as it's model, the AT&T Teaching Theater at the University of Maryland at College Park, Maryland. Previous research has evaluated the Teaching Theater in terms of its physical configuration and usability (Norman & Lindwarm, 1993; Norman & Carter, 1992). In this study, a comparison among the various software products currently used in the Teaching Theater will be made, with a specific focus on HyperCourseware, a specialized software package, developed primarily for the Teaching Theater.

The Classroom

The layout of the AT&T Teaching Theater is a lecture-style setup with the instructor at the head of the classroom facing the students. Figure 1 shows a schematic for this classroom at the University of Maryland. The instructor's desk contains the equipment necessary to operate all of the media in the classroom and to interface with the students' computers. The media used in the classroom includes: two 4'x 6' high resolution rear projection screens, a video overhead projector, a VCR, a video disc player and a CD player. In addition, the instructor has access to all of the students' machines, and using a video switcher, may display the contents of any student's screen on the instructor's monitor, which may in turn may be displayed on the front screen and/or on the other students' monitors. Finally the instructor has the capability to "take over" a student's display, to assist or make corrections.

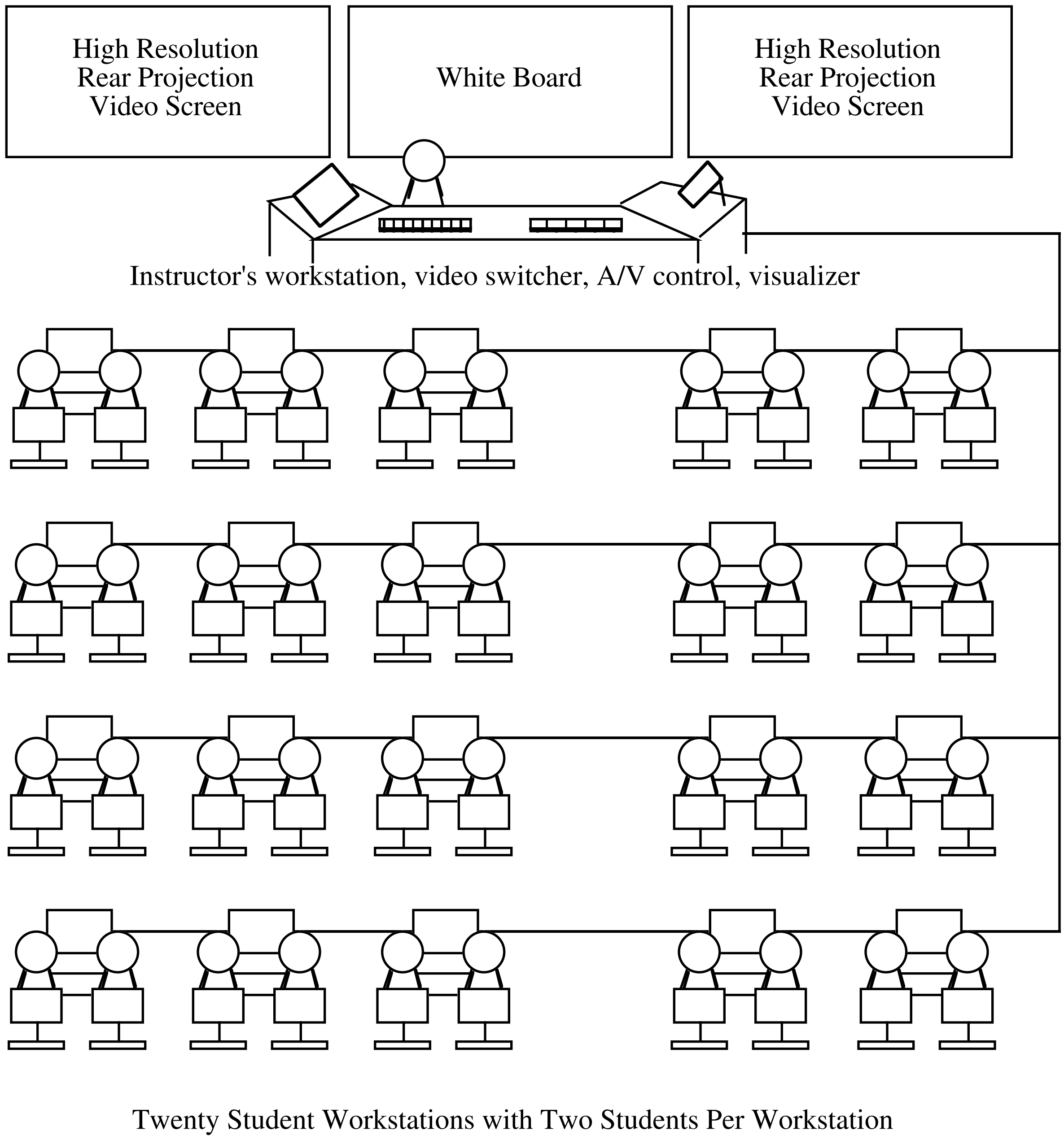

Figure 1. A schematic of the basic layout of the AT&T Electronic Teaching Teacher.

The students have access to 20 personal computer workstations (each workstation can serve two students - allowing for a total of 40 students per class). Each workstation is equipped with a keyboard, a mouse and a 17" high resolution color monitor, which is recessed into the desk to allow for good sight lines and to conserve space. The computers may be used to present class information (overheads, lecture notes, reading material), as scratch pads, for note-taking, or for computing purposes (programming, word processing, and networking).

The supporting computer systems are AT&T 25 MHz 386-based units. The computers are linked through an AT&T Starlan™ network, then through a Novell™ server and are eventually linked to the Internet, thus allowing students outside access to their accounts. For noise reduction, as well as comfort, the AT&T Teaching Theater is carpeted and the computer units are housed in an adjacent room. Environmental control for lighting is controlled by the control panel at the instructor's workstation.

Software

A major focus of this paper is the comparison among the many types of software packages used in the teaching theater. Table 1 in the Appendix shows the courses and their associated software packages used in the Teaching Theater for Fall semester 1992.

The following descriptions of the software products used in the Teaching Theater will give some insight into the breadth and variety of software used in the Teaching Theater.

Chat:	A Novell™ utility that allows the users to "talk" interactively on-line with each other. Chat is a groupware product which allows and encourages user interaction.
WordPerfect:	A stand alone, DOS-based word processor with automatic referencing, document comparison, dictionary and thesaurus, mouse support, mail merge, macros, table of contents generator, and text-integrated graphics.
Quattro Pro:	A spreadsheet that allows consolidation of data from more than one spreadsheet into a single spreadsheet, graph or chart. Quattro Pro has extensive spreadsheet publishing and graphics features for use in presentations, and a built-in draw program that allows you to edit you charts and graphs. Quattro Pro is primarily a stand alone product.

SAS:	A single user statistical package designed for data analysis and report generation.
GEDS:	The Global Events Database Editor was used in a Government/Politics class on "Conflict and Peace Analysis". It is a single user product.
Visionquest:	Marketed as a group decision support system (GDSS), VisionQuest offers a collaborative environment for sharing of ideas anonymously. Various tools in this system, especially brainwriting and comment cards, can be used in the academic setting for supporting a collaborative learning environment.
HyperCourseware:	"A system of interlocking programs and files that serves as an electronic infrastructure by creating tokens on a computer network that represent the familiar objects of instruction such as the syllabus, the class roll, lecture notes, exams, and grade lists." (Norman & Lindwarm, 1993)
Paradox:	A relational database manager that allows the user to access and manipulate data in many ways. The user can perform calculations, create graphs, and regroup information.

Most of these products are "Off-the-shelf" and were therefore, not designed specifically for the Teaching Theater. They have the advantage, though, of having gone through extensive product development and rigorous testing. In addition, most of these products work mainly as "stand alone" programs, that is they are intended for use by a single individual. A few of these products are actually intended for communication and decision-making purposes, and are used as such in the Teaching Theater. HyperCourseware, however, is the only product designed for the specific requirements and goals of the Teaching Theater by combining teacher-directed instruction with student input and the capability for interaction. Therefore, the development of HyperCourseware will be a primary focus of this paper. Issues concerning current usability problems will be addressed so as to better understand how this product can be improved for future use in the Teaching Theater.

HyperCourseware

Described as an "electronic infrastructure", HyperCourseware creates an environment in which the instructor can create lectures and discussion platforms, interactive experiments, surveys, quizzes and much more. In addition, the students and instructor can view the current day's seating chart, notes from previous classes, mail messages from the instructor or other classmates and can look ahead to upcoming classes by browsing the course syllabus. HyperCourseware attempts to utilize what is best about the Teaching Theater - the ability to combine lectures and student participation in one package. Figure 2 shows several examples of HyperCourseware screens.

Figure 2.

Examples of HyperCourseware Screens.

METHOD

Subjects

Thirteen classes were taught in the AT&T Teaching Theater in a variety of subjects ranging from English to Computer Science (see Table 1 in the Appendix), allowing for a varying degree of prior computer experience and course content. Each class had up to 40 students enrolled. In addition, the course offering ranged from undergraduate level to graduate level. Of the thirteen classes, eight participated in the survey, and five of the classes administered the survey on-line. The remaining three classes were administered as paper and pencil questionnaires. In addition, one course with a small enrollment was not counted in the final calculations as only one student participated in the survey. Participation was voluntary and the students were told that their answers and remarks would not have any effect on their grade in the course.

QUIS

The Questionnaire for User Interaction Satisfaction version 5.5 is a general test for usability which measures a user's subjective satisfaction with a particular interface (Chin, Diehl, & Norman, 1988; Harper & Norman, 1993). Questions used in the QUIS range from general interface satisfaction (i.e. Overall reaction to the system) to more detailed interface questions (i.e. rating the helpfulness of error messages). In addition, the QUIS has the capability of being tailored to the specific application being rated (i.e. "Were technologies in the classroom used to full potential?") The layout of the QUIS for this survey was as follows:

PARTS 1& 2: System and demographic information.
PART 3: Overall User Reactions (6 questions)
PART 4: Screen (4 questions)
PART 5: Terminology and System Information (6 questions)
PART 6: Learning (6 questions)
PART 7: System Capabilities (5 questions)
PART 8: Media Effect (4 questions)
PART 9: Technology (4 questions)
PART 10: Accessibility (1 question)

Each of the questions in parts 3-10 consisted of a 9 point (1-9) scale with an option of n/a for those questions which were not applicable.

Evaluation Procedure

During the last week of the semester, all of the students attending the Fall 1992 semester classes were administered the QUIS either on-line or in paper form. As noted in the previous section, students were asked to evaluate the software and other media in the AT&T Teaching Theater. Data were grouped according to combinations of Software used (see Table 1 in the Appendix). In some cases, two software products were grouped together for evaluation (such as WordPerfect with Chat, and Quattro Pro with SAS) since they were used together in a particular course. Unfortunately, since the survey did not distinguish between the two products the results cannot be clearly differentiated.

RESULTS

Table 2 lists the means for satisfaction on the overall reactions to the Teaching Theater. Since these values are highly correlated, a total score was calculated for each type of software. Table 3 gives mean satisfaction ratings for the more detailed information and Table 4 shows mean responses for AT&T-specific questions. Within each table the boldfaced items indicate significant differences among the products. The values, themselves, which are highlighted, represent specific significant contrasts. From these data, it is evident that overall, Quattro Pro had higher ratings as compared to HyperCourseware and Visionquest. In particular, questions concerning overall reaction ($p<0.01$), overall stimulation ($p<0.05$) and overall power ($p<0.05$) of the system, showed significant differences depending on the software used. This difference is also reflected in the Overall Totals score ($p<0.01$). For overall reaction, Quattro Pro and GEDS came out on top and HyperCourseware and Visionquest rated significantly lower. Additionally, Quattro Pro rated highly on questions involving system speed ($p<0.01$), reliability ($p<0.01$), (limited) media interference ($p<0.05$), and media helpfulness ($p<0.05$). Other areas which showed significant differences among the products include: how often the computer informs the user about what it is doing ($p<0.05$), computer helpfulness ($p<0.05$) and adequacy of learning time ($p<0.05$). Quattro Pro and GEDS were rated significantly higher than Visionquest and Paradox on the question of how much improvement the student experienced with the system ($p<0.01$). HyperCourseware also rated well with respect to Paradox on this question ($p<0.05$).

Although these data may at first look somewhat discouraging with respect to HyperCourseware, it is important to note that almost all of the mean scores for each set of data fall above the benchmark score of 5 on the scale. Graph 1, in the appendix, shows a scatterplot of the overall mean for the data with one standard deviation above and below the mean designated by the accompanying bars. It is interesting to note some of the outlying points on this scatterplot. Questions 4.1 (regarding readability of characters on the computer screen) and 7.3 (Noise of the system) both rated quite high (favorably) with overall means of 7.84 and 8.15 respectively. Conversely, questions 5.6 (Helpfulness of error messages) and 10.1 (Accessibility of the system from the Workstations at Maryland (WAM) labs) rated considerably poorer than the rest of the scores with overall means of 6.04 and 4.73. Similar results were shown in Graph 2 which gives the same information exclusively for HyperCourseware scores. Overall, the data reflects a rating in subjective user satisfaction well over the benchmark score of 5 on the 9-point scale, with the same issues noted as noticeably divergent scores.

DISCUSSION

As can be seen from the data collected, there are many discrepancies in student satisfaction with regards to the types of software used the Teaching Theater. On the one hand, the variety of software products demonstrates the great flexibility and diversity which the Teaching Theater has to offer. On the other hand, the great degree of variability among the different products makes them difficult to reliably compare. However, the purpose of this survey is to get a "feel" for how the students are responding to the Teaching Theater - whether the Teaching Theater provides a positive experience for the student (which it apparently does) and better understand some of its current shortcomings. In particular, the usefulness of HyperCourseware as a teaching tool should be evaluated, as it is a work in progress designed specifically for the AT&T Teaching Theater. From the data it is clear that HyperCourseware falls short in user satisfaction on a number of factors. These include: (a) Overall Reaction, (b) System Speed, (c) Reliability, (d) Media Helpfulness and (e) Media Interference. It did however, fare well regarding student improvement with computer usage over the semester.

It is necessary to mention here, that although we were able to gather some interesting feedback from the students, we were not able to control for a number of confounding effects of students groups and classes. The confounding factors include: experience levels of students between classes, the range in degree of difficulty and type of course curriculum (Statistics vs. History vs. Computer science vs. English), the level of involvement of the computer and the format of the class - lecture vs. discussion vs. group projects, etc. These confounding factors prevented a truly unbiased analysis among the different software products. Nevertheless, the feedback from the students does provide some groundwork for understanding what is successful and where improvement is needed. Additionally, it gives some suggestions about the advantages and shortcomings of HyperCourseware.

What is important to note, however, is that HyperCourseware is currently under development, whereas most of the other software products are fully developed marketed products. The factors regarding speed and reliability are heavily tied into the process of development - that is, newer programs that are in the development phase tend to be slower and less reliable. As for the interference of media - this is probably due to the high degree of media interaction used in these courses which utilized HyperCourseware. Again, the slow speed of processing probably added to the frustration level of the students and caused them to feel that the media interfered with their learning. Finally, it is interesting to note that the students felt that their ability to use the computer improved significantly during the semester. This is probably due to the fact that HyperCourseware required a great degree of user interaction. Overall, many of the features which cause HyperCourseware's low relative scores, are also factors which should improve through the normal course of the development cycle. Keeping in mind that HyperCourseware is a work in progress, it is important to understand that it, like the Teaching Theater, is being developed not just for the current classroom, but also for the classroom of the future. The main goal is to provide an enriching atmosphere for learning which will inspire students and promote a high level of academic performance.

ACKNOWLEDGMENTS

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APPENDIX

Table 1: Software Products and their associated courses:

SOFTWARE PRODUCT	**COURSE TYPE**
Chat	ENGL (English)
WordPerfect	ENGL (English)
Quattro Pro	ANTH (Anthropology), BMGT, (Business & Management) ENCE (Civil Engineering), HIST (History)
SAS	ANTH (Anthropology)
GEDS	GVPT (Government & Politics)
Visionquest	BMGT (Business & Management), ENGL (English)
HyperCourseware	PSYC (Statistics for the Behavioral Sciences), PSYC (Psychology)
Paradox	CMSC (Computer Science), ENCE (Civil Engineering)

Table 2:

Mean ratings on a 9-point scale (1-9) :

Notes (regarding the following 3 tables):

** = Significant difference(s) at the 0.01 level - (contrasts designated by **bold** type)
* = Significant difference(s) at the 0.05 level - (contrasts designated by **bold** type)

Comparisons among the various software products were analyzed by Scheffe F-test.

a) Overall (General) Measurements:

DESCRIPTION	**WP / CHAT**	**QUATTRO PRO / SAS**	**GEDS**	**VISION-QUEST**	**HYPER-COURSE-WARE**	**PARADOX**
Overall Reaction**	7.15	**8.00**	**8.17**	**6.27**	**6.11**	6.34
Overall satisfaction	7.23	7.29	7.08	5.88	6.08	6.05
Overall stimulation*	7.38	7.71	7.58	6.24	5.76	6.13
Overall ease	7.46	7.07	7.25	6.69	6.62	7.05
Overall power*	7.15	7.93	7.17	6.55	6.05	5.66
Overall flexibility	7.15	6.71	7.00	5.98	5.84	6.11
TOTALS**	7.25	7.45	7.37	6.27	6.08	6.22

Table 3:

b) Nonspecific Software Measurements:

DESCRIPTION	**WP / CHAT**	**QUATTRO PRO / SAS**	**GEDS**	**VISION-QUEST**	**HYPER-COURSE-WARE**	**PARADOX**
Readability of chars	7.83	8.14	7.75	7.84	7.89	7.58
Help of highlighting	7.58	7.36	8.33	7.23	7.03	7.26
Help of screen layouts	7.40	7.36	8.17	6.63	6.79	7.12
Clear screen sequence	7.67	7.50	6.90	6.59	6.79	6.94
Consistent use of terms	7.22	7.40	7.70	6.43	7.13	6.79
Relative terminology	6.80	7.70	7.62	6.42	6.60	6.75
Clarity of messages	7.54	7.27	7.50	6.57	6.86	6.70
Helpfulness of messages	8.00	7.20	6.75	6.48	6.68	6.94
Computer informs*	6.80	7.45	6.75	5.72	5.82	5.85
Help of Error messages	6.18	6.80	6.73	5.96	4.61	5.94
Ease of learning	8.00	7.17	7.42	6.49	7.08	6.90
Exploring Encouraged*	7.33	7.55	**8.00**	**6.38**	6.74	6.89
Ease of remembering	6.67	6.77	7.08	6.08	7.24	6.29
Straightforward tasks	6.91	7.08	7.67	6.54	6.66	6.89
Clarity of Help msgs	7.00	6.91	6.67	6.17	5.80	6.08
Clarity of suppl. refs	7.30	7.50	6.30	5.32	5.89	5.36
System speed**	7.40	**8.50**	7.08	6.69	**5.24**	5.82
Reliability**	7.40	**8.27**	6.92	6.72	**5.50**	6.05
Noise of system	8.40	8.58	8.58	7.67	8.32	7.35
Ease of correction	7.50	7.83	7.75	6.67	6.50	6.50
All levels of experience	7.00	6.42	7.00	5.84	6.29	6.51

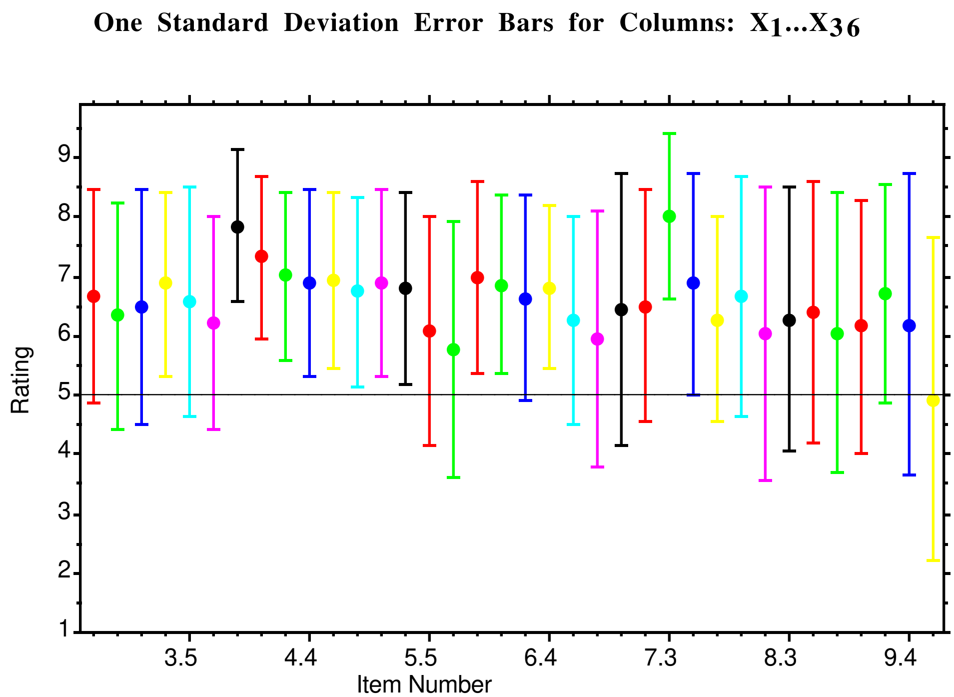
Table 4:

c) AT&T Teaching Theater-Specific Measurements:

DESCRIPTION	**WP / CHAT**	**QUATTRO PRO / SAS**	**GEDS**	**VISION-QUEST**	**HYPER-COURSE-WARE**	**PARADOX**
Instructor integration	n/a	7.77	6.80	6.26	6.79	6.58
Media interference*	n/a	**8.08**	7.30	5.84	**5.16**	6.17
Media helpfulness*	n/a	**8.17**	7.00	6.12	**6.05**	5.42
Computer helpfulness*	n/a	7.79	7.36	6.18	6.16	5.70
Tech used to potential	n/a	7.36	6.67	5.88	6.00	5.06
Adequate time to learn*	n/a	6.43	7.58	5.52	6.27	6.47
Ability to attend	n/a	7.08	7.75	6.23	6.95	6.65
Improvement**	n/a	**8.36**	**8.50**	**5.69**	**6.27**	**4.08**
Accessibility from WAM	n/a	4.64	4.54	5.71	4.09	4.68

n/a = No data collected for this group.

Graph 1: Scatterplot of Overall Ratings (for all software products combined):



Graph 2: Scatterplot of HyperCourseware Ratings: