A MODEL FOR COMBINING COMPUTER-BASED DISTANCE LEARNING WITH IN-CLASS INSTRUCTION

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ABSTRACT
The use of computer-based distance learning has grown rapidly in recent years and, for those students who find their learning style suited for online study, these courses have provided a flexible option for the completion of course work. However, some students who would prefer to take a course in a traditional on-campus lecture format find it necessary, due to such reasons as family or job obligations, to take an online course to complete their degree requirements. To better serve this latter type of students, a model was developed for a blended course that combines the flexibility of computer-based distance learning with the benefits of face-to-face instruction. This paper presents a description of the In-Class, ONline (ICON) model of instruction that has as its goal the use of appropriate technology to provide quality instruction while reducing the amount of time a student is required to be on campus. In particular, the ICON model's structure consists of an in-class component that focuses on concept development and mastery, an on-line component comprised of tutorial materials and formative assessment tools to gauge student progress, and a resource component that consists of the textbook and a workbook designed to coordinate the in-class and on-line activities. The efficacy of the ICON model as applied to an introductory Astronomy course is then discussed through a preliminary analysis of student satisfaction with the model and its components and a comparison of grades with a traditional classroom-only section.

KEYWORDS
Teaching and learning in science, distance learning, learning environments

INTRODUCTION

The use of computers in teaching has grown in recent years, with both "traditional" classroom instruction and distance learning benefiting from the capabilities and advances of the technology. Computer-based distance learning courses are emerging on more and more campuses and internet-linked classrooms are becoming an ever-increasing component of on-campus instruction. Indeed, in some cases, an increased accessibility to technology coupled with assignments involving students work outside the classroom has blurred the distinction between on-campus and off-campus learning (Young, 2002). In particular, for those students whose style of learning is conducive to the independent, self-paced nature of distance learning, online courses have provided an option to "go to school" that can be combined with work and/or family responsibilities. However, those same responsibilities may make taking distance learning courses the only option to continue with an education. Recent surveys given by the author to students enrolled in his internet-based astronomy courses confirmed this assertion. In two courses, 67% and 44%, respectively, of those responding indicated a preference for taking on-campus, face-to-face courses, with typical reasons for taking the online course given as family or work obligations and scheduling conflicts with other courses. To better serve the needs of these and other students, the author set about to develop a model of instruction along the lines of a hybrid course (Garnham and Kaleta, 2002; Murphy 2002) that combines the strength of in-class instruction and with the assessment and delivery capabilities of online platforms. The result of this effort is the In-Class, ON-line (ICON) model of instruction that has as its general goal the use of appropriate technology to provide quality instruction while reducing the amount of time a student is required to be on campus. In its initial trial, the model was applied to an Introduction to Astronomy course at the author's institution.

DESCRIPTION OF THE ICON MODEL

As shown in Figure 1, the ICON model consists of three components; the resource component, the in-class component, and the on-line component.

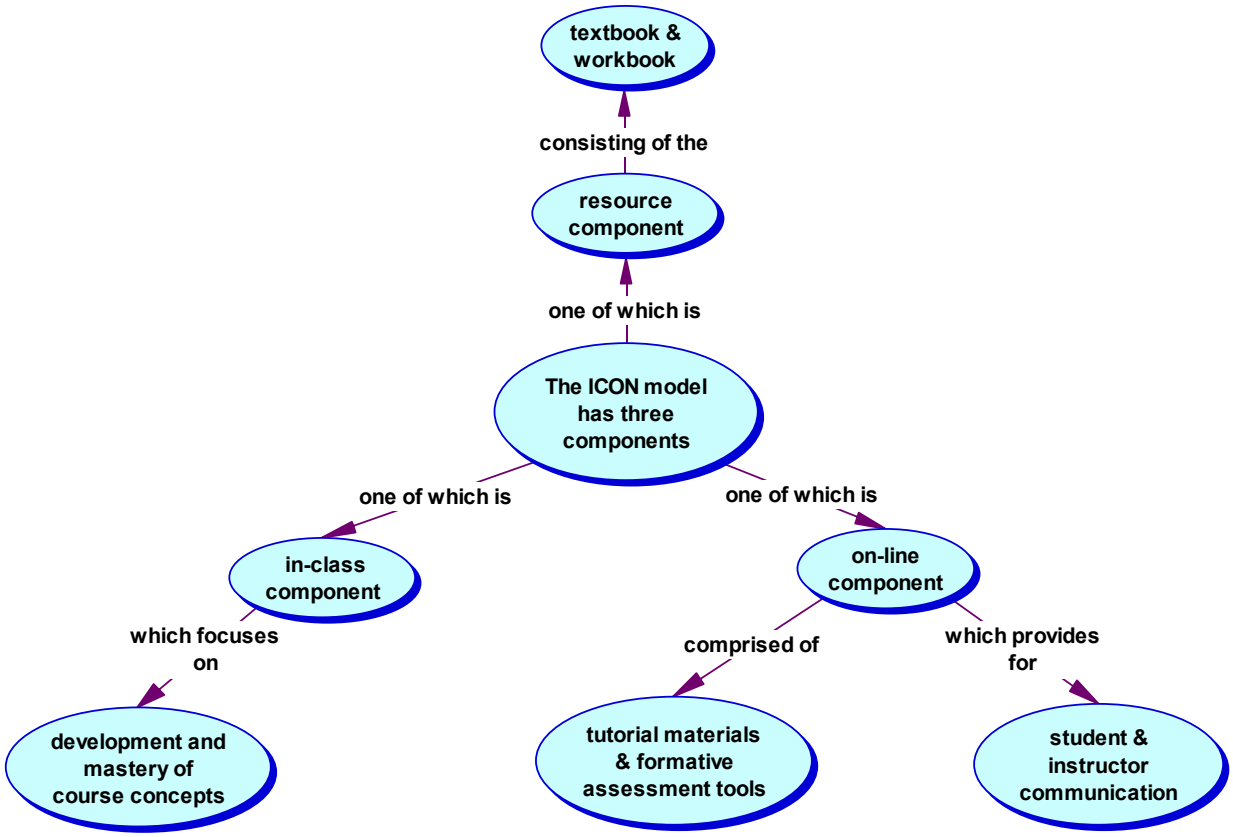

Figure 1. Structure of the ICON model

More specifically, the objectives and content of the three components are as follows:
I) *The resource component* - This component consists of a textbook and a workbook. The textbook is the source of most of the course content, while the workbook coordinates learning objectives, notes, in-class and on-line activities, and other course information. A typical workbook page, as seen in Figure 2, lists the learning objectives (competencies and sub-competencies), terms to be defined, text reading assignments, as well as pre-session, session, post-session activities, and a concept map of what is to be covered in the session.
II) *The in-class component* - The in-class component, which meets once a week for two hours, focuses on the development and mastery of course concepts through instructor presentations and small group cooperative learning activities. More specifically, the presentations in the in-class component focus on the session topics indicated in the workbook session descriptions (See Figure 2). Class time is not used to transfer information but rather to
understand the information. By completing on-line activities, students will have already been exposed to the material and terms to be used in the presentation. Through in-class discussions

Week 1 Session 2:

Session Description: In this session, we will begin to cover course competency 1and its subcompetencies.

Competency 1 - Describe the night sky, the model used to represent it, and the motions of the sun, moon, and planets across it.

Subcompetency 1.1 - Define constellations and explain their origins
Subcompetency 1.2 - Explain the two ways in which stars are named and describe the method used to compare the brightness of stars
Subcompetency 1.3 - Define and describe the celestial sphere and reference points on the celestial sphere

Pre-session:
Define: constellation, asterism, magnitude scale, apparent visual magnitude, celestial sphere, north and south celestial poles, precession
Take: Pre-Session Quiz*
Review: Session 2 concept map
Read: Chapter 2
Session topic:
The magnitude scale and the celestial sphere
Tutorial: The Magnitude Scale*
Post-session:
Review: Session 2 notes
Take: Post-Session Quiz*
Submit: Answers to Subcompetemcies 1.1 to 1.3*

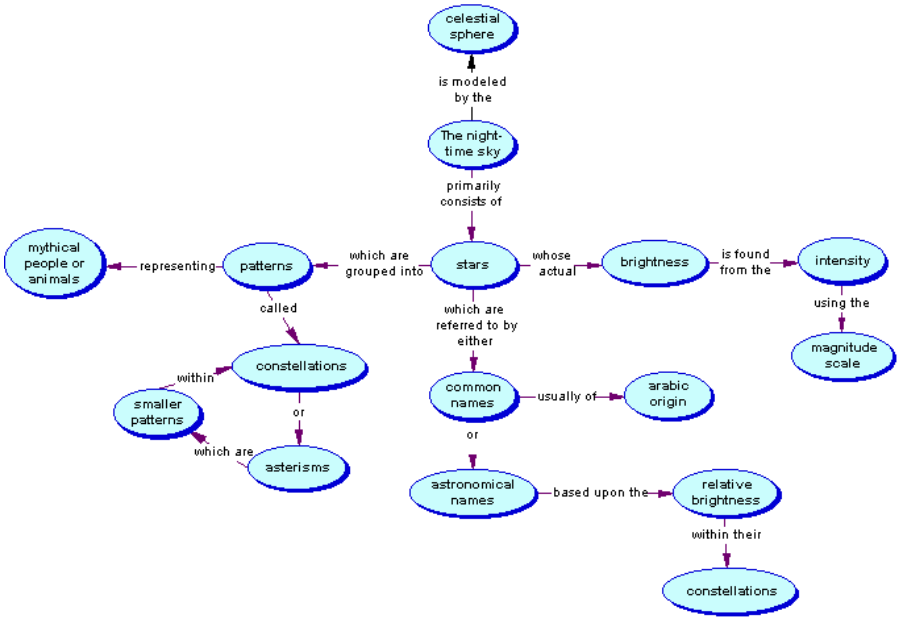

Figure 2. A typical workbook page

and questions, the classroom time is used to review and discuss the concepts encountered in the course. Following the presentation, students reinforce their understanding of the concepts by participating in small group activities. These small groups also permit for one on one interactions between the instructor and students, thereby giving students to opportunity to address any remaining problems or misconceptions.

III) *The on-line component* - This component has as its main goal the formative assessment of student progress in the course, which is accomplished through online quizzes and interactive exercises. In particular, as seen in Figure 2, students take an on-line quiz (indicated by an asterisk *) after studying the terms associated with the pre-session activities and an another on-line quiz (as part of the post-session work) after the class has met. Consisting of true/false, multiple choice, and completion questions, these quizzes are designed to assess both the students knowledge of the terms to be used in the session (pre-session quizzes) and their understanding of the concepts presented in the session (post-

session quizzes). Furthermore, the submission of answers to the learning objectives (subcompetencies) as stated in the workbook for each session represents another opportunity for the instructor to gauge student progress. In addition to the assessment of student progress, the on-line component is used to by students to preview the materials to be presented in class. These materials, in the form of tutorials, present and discuss the concepts to be covered in the subsequent in-class meeting. Student-discovered internet links pertinent to the concepts being studied are also posted on-line and may be viewed by other members in the class. Still another function of the on-line component is availability of student/instructor communication outside the classroom. Through email, the instructor addresses student questions not answered in class may be addressed and other important information such as course-related television programs and news events in astronomy may be communicated. Hence, this component of the model was able to provide formative assessment directed at specific learning outcomes of the course (Mazzolini, 2000).

IMPLEMENTATION OF THE MODEL

To implement the model, the author selected an existing in-class only Introduction to Astronomy course that met for three hours one day a week (Thursday afternoon) as the experimental section. In general, students enroll in this class to fulfill a non-science major science elective for their degree programs. The length of the in-class portion of the class was reduced to two hours, with one hour per week of on-line work required. As part of the model implementation, students were advised prior to signing up for the class that on-line work was required. The first class meeting was used both to describe the course and the internet platform used to support the on-line activities and to begin the course material. Thereafter, the author sent weekly updates to students via the internet.

Prior to each subsequent session, students defined the terms used in the upcoming session, take the pre-session quiz, review the concept map outlining the session, and read the appropriate sections of the text, as indicated in Figure 2. Concepts were then reviewed and ideas solidified in the in-class session. Tutorials used in the in-class component were accessible on-line by students to be previewed prior to the session. After the class meeting, students took another on-line quiz and submitted responses to the show how they had achieved the learning objectives stated in the sub-competency statements.

The following formative assessments monitored student progress in achieving the course competencies:
Pre- and post-session quizzes - As illustrated in the workbook page shown in Figure 2, students took on-line quizzes both prior to and after each in-class session. In line with the formative nature of the quizzes, students received points for taking each quiz, not for the number of correct answers recorded. The instructor then reviewed the individual results of the quizzes to assess the level of achievement in understanding the terms and concepts of the course. If a problem appeared as the result of a poor performance on a series quizzes, the instructor could intervene to diagnose the difficulty.

Sub-competency submissions - By reviewing the student responses to the sub-competency statements for a specific session, the instructor was able to determine how well students were integrating the course material and reaching course learning objectives. After reading each response, the instructor then replied, when necessary, with comments or suggestions on what changes were required to ensure the learning objectives were achieved. The student could then submit an edited response to be reviewed again by the instructor. As with the quizzes, students received credit for submitting their sub-competency responses.

In addition to the quizzes and sub-competency submissions, students could submit draft responses to potential exam essay questions posted on-line. The instructor reviewed the responses and returned comments to the students. This activity provided a good opportunity for additional one-on-one interactions between students and instructor. Furthermore, students could find, review, and post internet sites of relevance to the concepts being covered. Besides being a source of additional credit in the course, other students in the class could review these links and obtain alternate explanations and descriptions of course topics.

DISCUSSION OF MODEL EFFECTIVENESS

The efficacy of the initial implementation of the model was investigated through two means; a survey of student satisfaction with various aspects of the course and a comparison of exam scores from the previous semester. In particular, students rated their levels of satisfaction using a five point scale in general areas such as the in-class and on-line components, instructor communication, website friendliness, and with specific instructional methods and materials making up the three components of the ICON model. The questions and results are indicated in Figures 3 and 4 for a total of fifteen student responses.

Scale: 1 - Very dissatisfied to 5 - Very satisfied

1. What is your overall level of satisfaction with the course? 4.6

2. What is your level of satisfaction with how the lecture component of the course has helped you learn the course material? 4.8

3. What is your level of satisfaction with how the online component of the course has helped you learn the course material? 4.0

4. What is your overall level of satisfaction with your instructor? 4.9

5. What is your level of satisfaction with the communication between you and your instructor? 4.7

6. What is your level of satisfaction with the accessibility to your instructor? 4.7

7. What is your level of satisfaction with your instructor in posting your grades, giving you assignment feedback, and keeping you informed about exams dates, and other related course events? 4.9

8. What is your level of satisfaction with the reliability of the website used in the course? 4.1

9. What is your overall level of satisfaction with the website used in the course? 4.2

10. What is your level of satisfaction with the effectiveness of the different components (MAIL, FORUM, TIMELINE, etc.) of the website? 4.6

11. What is your level of satisfaction with the "user-friendliness" of the different components of the website? 4.6

12. What is your overall level of satisfaction with the organization of the course on the website? 4.4

13. What is your level of satisfaction with how assignments done on the website (quizzes, subcompetency submissions, etc.) helped you meet the objectives of the course? 4.5

Figure 3. Student responses to general area questions

Some conclusions regarding the ICON model's effectiveness as suggested from questions 1 to 13 of the survey are as follows -

- Students showed a high level of satisfaction (>4.0 response) with the use of the ICON model as a means to help them learn course material and achieve course objectives (questions 1, 2, and 3). A possible conclusion drawn from these results is the acceptance by the students of an on-line component as a part of a "regular" in-class course. These results also suggest that, while they were satisfied with the online component, students in the class still have a preference for face to face instruction as compared to on-line learning (questions 2 and 3).
- The results from survey questions 4, 5, 6, and 7 indicate that students felt a high level of satisfaction in their communications with the instructor and with the instructor's availability and provision of information pertinent to the course. These results, coupled with the response to question 2, suggest that, just as with traditional lecture courses, teacher/student interactions must also play a major role in applying the ICON model.
- The responses to questions 8 to 12 demonstrated the effectiveness of the website containing the on-line component of the ICON model. The response to question 3 also possibly reflects upon the importance of an effective website.

- The high level of satisfaction expressed in response to question 13 indicates that students recognized the value of the work performed on-line and accepted it as necessary for success in the course. As mentioned previously, the results suggest that the students accepted and were comfortable with an on-line component as a necessary part of the course. Further investigations aimed at determining the level of acceptance of and comfort in using on-line components in traditional classes will be a part of future implementations of the model.

14. Rank the following as to how frequently you have used them in the course.
(1 = not very frequently to 5 = very frequently)

a) Text	3.9
b) Webstudy Website	4.2
c) WorkBook	4.2

15. Rank the following as to how helpful they have been for you in learning the course material.
(1 = not very helpful to 5 = very helpful)

a) Text	4.1
b) Workbook	4.5
c) Concept Maps in Workbook	4.2
d) Crossword Puzzles	3.4
e) In-class Group Activities	4.1
f) Concept Maps in Lectures	4.5
g) PowerPoint Presentations	4.4
h) Videos	3.6
i) Online Tutorials	4.2
j) Online Pre & Post session quizzes	4.5
k) Online subcompetency submission	4.2
l) Online group Activities	4.0
m) Online Practice Exams	4.7

Figure 4. Student responses to specific instructional methods and materials questions

A review of the results of survey questions 14 and 15 indicate the following conclusions -

- The responses to questions 14b and 14c suggest that the students viewed the on-line components of the model as necessary parts of the course and used them uniformly with the text at a high level of frequency. This finding is consistent with the response to question 13.
- In particular, the text and workbook (the elements making up the resource component of the model) were rated at a high level of helpfulness in learning the course material (questions 15a to 15c). Thus, the workbook successfully fulfilled its function as a means of coordinating activities in the model. Students also viewed the use of concepts maps as part of the workbook as helpful in their learning (question 15c).
- The ability of the in-class component to meet its objectives of developing and mastering course concepts was supported by the responses of questions 15e to 15h. More specifically, the use of group activities along with lectures incorporating concept maps to structure the course material were rated as very helpful in learning course material.
- The responses of questions 15i to 15m indicate that the objective of the on-line component to gauge student progress through formative assessments was successfully achieved. Students gave high ratings to the pre- and post-session quizzes, on-line subcompetency submission, and on-line practice exams as helpful ways to achieve the course objectives.

In summation, students expressed an overall high level of satisfaction with the ICON-structured course in regards to its assistance in learning the course material. These results were consistent with other studies of similar hybrid courses (Guessoum, 2002; Riffell and Sibley, 2002).

The second means of determining the effectiveness of the model was a grade comparison between a traditional class and the class structured after the ICON model, the results of which are shown in Figure 5.

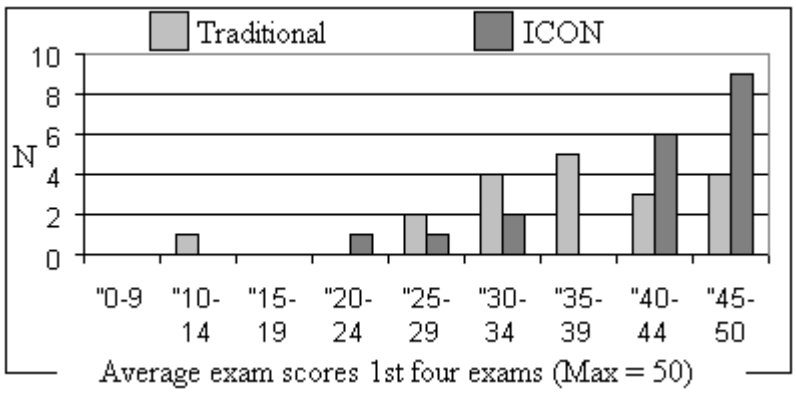

Figure 5. Comparison of traditional and ICON Astronomy exam scores (N=15 for both courses)

In particular, the average exam scores for students completing the first four exams (of a total of five exams given) in the ICON modeled class were compared to the average determined in the same manner for a traditional class section offered the previous year during the same time of day. Exams consisted of true/false, multiple choice, and completion questions, along with an essay question and figures or graphs to be labeled. Furthermore, the same exam was given to each of the classes studied.

Of particular interest when viewing the graph is an apparent shift to higher averages for the ICON students. More specifically, the ICON class showed fewer students in the middle range of exam scores (exam averages of 25 to 39) and more in the higher range (exam averages of 40 to 50), indicating that the model may have provided these students with the assistance needed to achieve a higher level of learning. These results are again consistent to those obtained by other investigators (Riffell and Sibley, 2002). Indeed, the fact that the model class score equal to or better than the traditional class indicates that the use of the on-line and resource components did not negatively influence learning. Given the limited number of students in each class, no further conclusion may be drawn. Determining the validity of this shift to higher exam scores must be another priority of future applications of the model.

FUTURE PLANS

Future plans call for another implementation of the model in a situation similar to the one described in this paper, with the gaining a clearer conclusion regarding the acceptance of a computer-based course component as a major goal. In addition, future applications of the model will examine the validity of the shift to higher exam scores as indicated in Figure 5.

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REFERENCES

Garnham, G. and Kaleta, R. (2002). Introduction to Hybrid Courses. Teaching with Technology Today, 8(6).

Guessoum, N. (2002). Overcoming Students' Passivity Through Online Discussion Boards and Self-Quizzing, The International Online Conference on Technology in Higher Education, November12 - 14, 2002. This paper is available online at: http://www.ipfw.edu/as/tohe/2002/Papers/guessoum-long.htm

Mazzolini, M. (2000). Assessment Techniques in an Online Astronomy Course, Electronic Publications of the Astronomical Society of Austrailia, 17(2), pages 141 - 144. This paper is available online at: http://www.atnf.csiro.au/pasa/17_2/mazzolini1/

Murphy, P. (2002). The Hybrid Strategy: Blending Face-to-Face with Virtual Instruction to improve Large Lecture Courses, University of California TLtC News and Events Webzine. This paper is available online at: http://www.uctltc.org/news/2002/12/feature.html

Riffell, S. and Sibley, D. (2002). Hybrid Course Formats for Integrative Studies Courses: Preliminary Results from Assessment Experiments, Michigan State University. This paper is available online at: http://www.msu.edu/~riffells/cnb/update2002.htm

Young, J. (2002). 'Hybrid' Teaching Seeks to End the Divide Between Traditional and Online Instruction, The Chronicle of Higher Education, 48(28), March 22, 2002.

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