

Full Length Research Paper

Effective course design methodology for online teaching and learning on Angel course management system

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Accepted 23 November ,2012

In recent years, there has been an enhanced trend to switch over from face-to-face (F2F) to online teaching/learning methodology. Effective online course design technique requires careful thinking and long-range planning, which must be done in a user-friendly way so that the pertinent student/user may not encounter an unexpected obstacle or some sudden surprise. Recently, several SUNY Universities including SUNY Fredonia have started or in the process of teaching online courses using the SUNY Learning Network (SLN) ANGEL Course Management System (ACMS). The current article discusses a useful and practical way of designing effective online courses for arts, humanities, natural science, engineering, and medical education undergraduate and graduate students. It also provides basic guidelines to the Universities/College instructors who are interested or planning to design and teach online courses in the near future. It employs several useful teaching and learning tools such as Assessment and Survey Editors, Grade Book and Drop Box facilities, Discussion Forums, course Calendar, Web Links, Blogs, Lesson Plans, Files, Folders, Pages of ANGEL server for online course development and teaching purposes. We explore constructive discussions of Assessment and Survey Editors that can be used to create and give online Exams/Quizzes with several types of questions such as multiple-choice, true/false, matching-style, and essay-type questions. Finally, the suitability of this effective teaching/learning online methodology is tested with the help of student survey data collected for several F2F and online Computer and Information Systems courses taught in SUNY Fredonia. We believe that the same online course design methodology could be adopted on the Blackboard and Moodle, Sakai e-learning course management systems to teach online courses.

Keywords: Provide keywords

INTRODUCTION

The modern digital age has brought numerous changes how students can learn and instructors deliver the instructions with the help of new software systems in traditional F2F class-room setting as well as in an online teaching/learning methodology. ANGEL is an e-learning management software system, which has been extensively employed in several public and private educational institutions in our country (Shively and Ketcham, 2009). This software system is a product of an Indiana based software company (www.blackboard.com/Teaching-Learning/LearnResources/ANGEL-Edition.aspx). It is a web-based

teaching/learning management system (TLMS) with which instructors can easily manage their course materials for F2F as well as online teaching purposes and can communicate very effectively with the students. Therefore, ANGEL can serve the two following fundamental functions: (a) An instructor can use it as a traditional face-to-face (F2F) teaching/learning tool, and (b) it also offers an effective online instruction delivery system, i.e., an interactive web-site for distance e-learning. With the help of ANGEL, instructors can, with great ease, post any kind of document pertaining to the online course-work, such as the course syllabus, power point lecture notes embedded with audio-voice, video clips similar to those posted on YouTube, course announcements, student data files pertinent to a given discipline, administer student surveys, student

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evaluations, etc. In addition, one can establish a link or hyperlink to any website that can be useful for the course work. One of the important advantages of ANGEL that we have discovered is an assessment tool, which is very useful and time saving for designing online and F2F quizzes/tests. This is due to the fact that once the quiz/test is finished by students the instructor has an immediate access to the student grades, its statistical analysis and even student scores in a graphical form. An instructor can then transfer the student grades to an MS Excel Spreadsheet if he/she is keeping records of grades in such a manner. An instructor can send and receive course e-mail through ANGEL e-mail facility. He/she can establish and monitor discussion/threaded discussion forum (Rizopoulos and McCarthy, 2009) and chat-room, receive and grade uploaded home assignments using online drop boxes, create group/team for discussions or special projects and much more. The course "Calendar" can be used to post live office hours and assignment due dates as well as the date on which a given quiz/test is going to be held.

The following comments are recently made by Mr. Ray Henderson, chief products officer, ANGEL Learning, "While we emphasize headlines about new product features, the real story about ANGEL is one of refinement and balance. By listening to our users, we found numerous areas where we could improve the experience for the most frequently performed actions. We've reduced steps to action; increased leverage with batch functionality and added greater power to automate routine steps. Our customers have also helped us envision and develop innovative new ways to add instructional power and perspective to discussion forums." We completely agree with Mr. Ray Anderson's comments. As cited in ANGEL website (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx), it provides the following additional benefits for instructors and students:

- Simplified Discussion Forum Management and Evaluation
- Algorithmic Questions Enhance Assessments
- User-Interface Enhancements Ease Individual Customization
- Improved Documentation Reduces Support Burdens

Similarly for system administrators and institutions, ANGEL provides the following additional features and benefits (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx):

- Redesign Administrator Console Advances Usability
- Agent Technology Improves SIS Data Integration

In a recent investigation, it has been found that online learning continued to grow at a much higher pace in comparison to traditional F2F course enrollment (Allen and Seaman, 2007). Therefore, it is very critical to do experimentation with new teaching/learning software

systems and strategies to achieve the most productive and satisfying experience for the first-time online learners. There is also a need to address the role of educational technology globally on higher education in a comprehensive way. Since 1995 with the introduction of LotusNotes

(www.ibm.com/developerworks/lotus/library/ls-NDHistory/ available on 31/03/2011), which was successfully used until summer of 2009 many new software systems have emerged, e.g., WebCT (Curtin, 2002), ANGEL (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx), BlackBoard (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx), Moodle

(www.moodle.org available on 31/03/2011), Sakai (www.sakaiproj.org, available on 31/03/2011) and to name a few. At SUNY Fredonia (FSU), we have been using ANGEL course management system for over four years now. We discuss the application of ANGEL educational technology in this paper. We developed hybrid learning model that integrates both the synchronous and asynchronous learning. We focus on two approaches to make Computing Sciences education more effective without compromising its quality. From our personal experience of teaching both F2F and online courses on ANGEL from past six years in the Department of Computer and Information Sciences, we would recommend the usage of ANGEL course management software system not only for science and engineering instructors/learners but also for humanity and arts professors/students of SUNY Fredonia. We hope instructors from other universities and colleges who have employed ANGEL software system for the teaching/learning purposes would corroborate with our statement.

Organization of current article is done as follows: Section 2 is devoted to an effective design and creation of course modules on ANGEL server. This Section is subdivided into seven sub-sections: (i) Course Map, (ii) Welcome Message from Course Instructor, (iii) Introduce Yourself, and Some Useful Links, (iv) An Introduction to ANGEL Nuggets, (v) Student Data files if any, (vi) How to Submit Your Assignment on ANGEL? (vii) Week 1 Module, which is split up into two Sub-Modules, i.e., Module 1 and Module 2. Section 3 reports statistical data analysis of four F2F and five online computer science courses taught by the authors in SUNY Fredonia. Finally, conclusions of the present investigation are presented in Section 4.

Creation of course modules on angel server

For a good and an effective online course design, it is very important to employ a modular structure in its creation. In general, these modules reside in ANGEL "Lessons" Nugget since almost entire course material sits

in “Lessons” Tab. In what follows, we will have a short discussion of each of the eight modules existing in “Lessons” Tab, which is done for numerous well-designed online J-Term/Summer courses taught by the authors in the Fredonia Department of Computer and Information Sciences.

Course Map

The first item in “Lessons” Nugget on ANGEL should be your Course Map, which may have a different outlook or structure depending on which course is being taught. For sake of simplicity, we are presenting two Course Maps: one for J-Term two-week course that was taught in SUNY Fredonia during Christmas break and the other one for a Summer Session of five-week duration course. To be familiar with Course Map for a two-week J-Term course, an instructor is supposed to examine carefully the structure of the following eight Main Modules in “Lessons” Tab:

- Course Map
- Welcome Message from Your Instructor
- Introduce Yourself and Some Useful Links for Students
- An Introduction to ANGEL Nuggets
- Student Data files (if any)
- Instructions: How to Submit Your Assignment on ANGEL
- Week 1
 - Module 1
 - Module 2
 - Module 3
 - Module 4
 - Module 5
- Week 2
 - Module 1
 - Module 2
 - Module 3
 - Module 4
 - Module 5

For a five-week summer course, an instructor is required to implement some modifications in the modular structure in order to deliver the course work in five weeks rather than in a two-week time span of a J-Term course. The basic structure of Course Map remains unchanged, but course material is to be distributed in five weeks in place of two weeks for a J-Term course. A typical Course Map for a summer session course running over a five-week period will have eleven Main Modules, and its design looks like as presented below:

- Course Map
- Welcome Message from Your Instructor
- Introduce Yourself and Some Useful Links for Students
- An Introduction to ANGEL Nuggets
- Student Data files (if any)

- Instructions: How to Submit Your Assignment on ANGEL
- Week 1
 - Module 1
 - Module 2
- Week 2
 - Module 1
 - Module 2
- Week 3
 - Module 1
 - Module 2
- Week 4
 - Module 1
 - Module 2
- Week 5
 - Module 1
 - Module 2

For an actual screen-shot of Course Map for a five-week online summer course designed by the authors, a reference may be made to [Figure 4](#) in section 2.2.5. For a good course design, all above mentioned modules should be used. Students must explore these modules and thus, be familiar with the basic course setup. At the end of Course Map, an instructor may thank the students for registering in his/her course and can include a proper copyright text or paragraph.

Welcome Message from Course Instructor

This Module is in the form of a folder and can be created using one of the several options existing in “Add Content” on ANGEL server, e.g. see [Figure 1](#). Here, an instructor is supposed to introduce himself/herself to the students. Instructor may make a mention of his/her academic and professional qualifications such as teaching experience and what kind of research work is being done etc. The total length of text in this Module should not exceed more than two typed pages.

Introduce Yourself and Some Useful Links

It would be really a good idea to have this Module in the form of a “Discussion Forum”. Here, students are allowed to post a brief introduction about him/her. Instructor must give a brief set of instructions to the students how should they post their introduction.

In addition to it, an instructor must establish some useful links for the students, e.g., a link to department website from where contact to the department chair or secretary can be made by the students. To find relevant course resources, a link to the educational institute library must exist in present Module. A link to the course tutorials on internet, where students can test their learning skills or practice some exercises concerning the course work, should also be established in this Module.

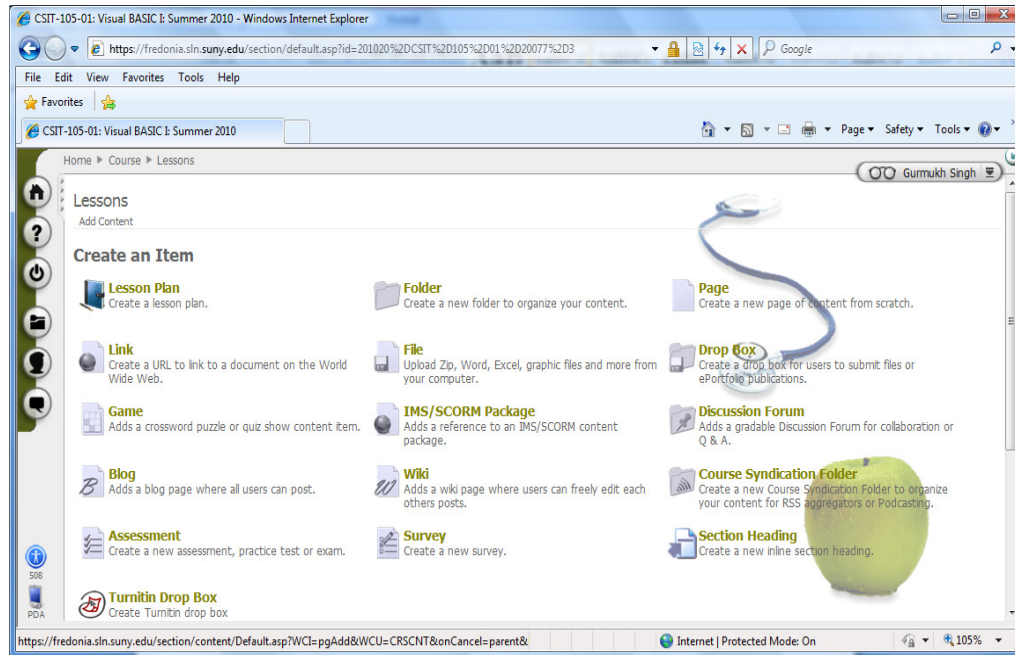


Figure1. A screen-shot of several items that can be added using “Add Content” option in instructor’s online course website

An Introduction to ANGEL Nuggets

To make your students familiar with ANGEL Graphical User Interface (GUI), we have included seven screen-shots of most commonly used Tabs or Nuggets. Actually, ANGEL GUI has in total eight Tabs. For online courses, CSIT 105, CSIT 205, CSIT 107, CSIT 207 taught by us during past J-Term 2010 and summer 2010, in general, we can use seven Tabs out of a total of eight.

“Course” Nugget

The first Tab could be “Course” Tab and its screen-shot is shown in **Figure 2**. There are two windows in this screen-shot. The left-hand-side window is called “Activity at a Glance” and on the other hand, the right-hand-side window is called “Course Announcements”. “Activity at a Glance” window has a provision of four bar graphs: (i) Logons, (ii) Mail Messages, (iii) Discussion Posts, and (iv) Submissions. All important course announcements go in the “Course Announcements” window and they will also be posted in “Calendar” Tab.

“Calendar” Tab

The second tab in ANGEL GUI is known as “Calendar”, which will have information of all important due dates of assignments and plus on which dates an Exam or Quiz is to be held. Its screen-shot is shown in **Figure 3**. There is

a single window in this screen-shot. It is possible to plug-in all the important dates pertaining to an online course work. Please ask your students to visit the course “Calendar” frequently, i.e. at least once or twice daily in order to track down any new information posted.

“Lessons” Nugget

The third tab in ANGEL GUI is known as “Lessons” Tab, which will have several folders, e.g., Course Map, Welcome Message from Your Instructor, Introduce Yourself and Some Useful Links, Student Data files (if any), Instructions: How to Submit Your Assignment on ANGEL, Week1, Week 2, Week 3, Week4 and Week5 folders. Each of Week1 through Week 5 folders will have two Modules. Explore each Week folder very carefully. PowerPoint Lecture Notes of each chapter of your textbook, Lab Assignment Handouts, Exam/Quiz Handouts, Lab Assignment Drop Boxes, and Exam/Quiz Drop Boxes etc are posted here. A screen-shot of “Lessons” tab is shown in **Figure 4**. There is a single window in this screen-shot. It is possible to plug-in all important modules pertaining to your course work as mentioned above.

Resources Nugget

The fourth Tab in ANGEL GUI is known as “Resources” Tab, which will have two windows, e.g., “About This

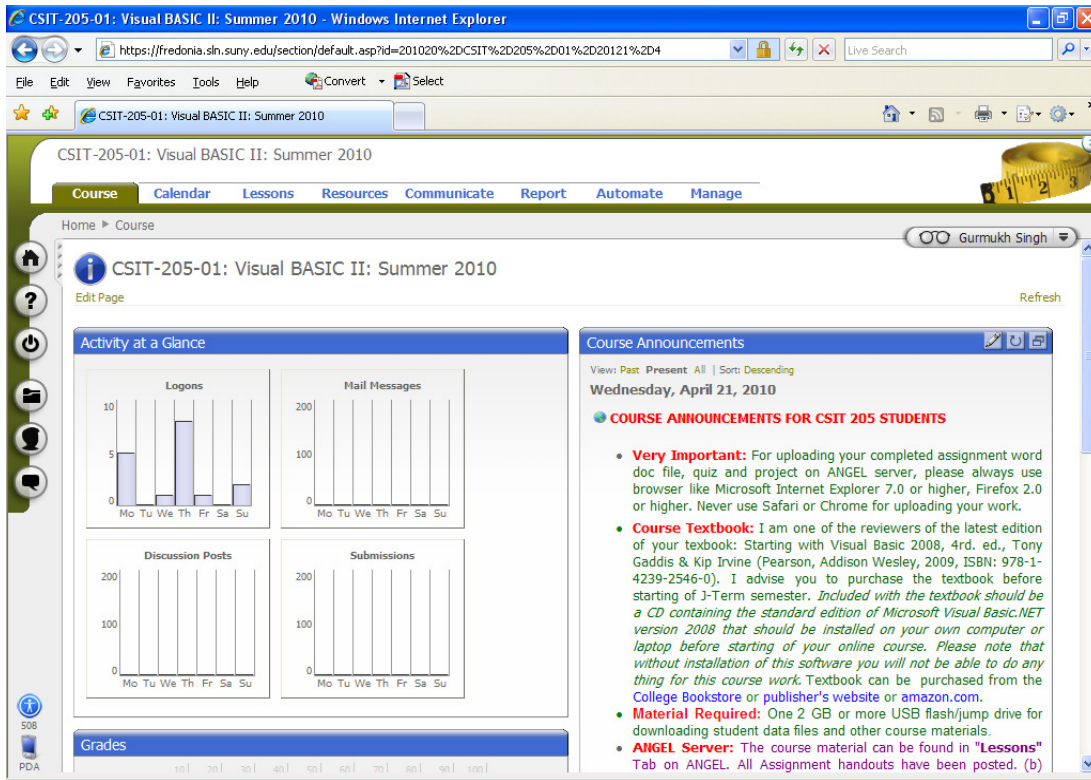


Figure 2. An actual Screen-shot of ANGEL "Course" or "Group" Tab

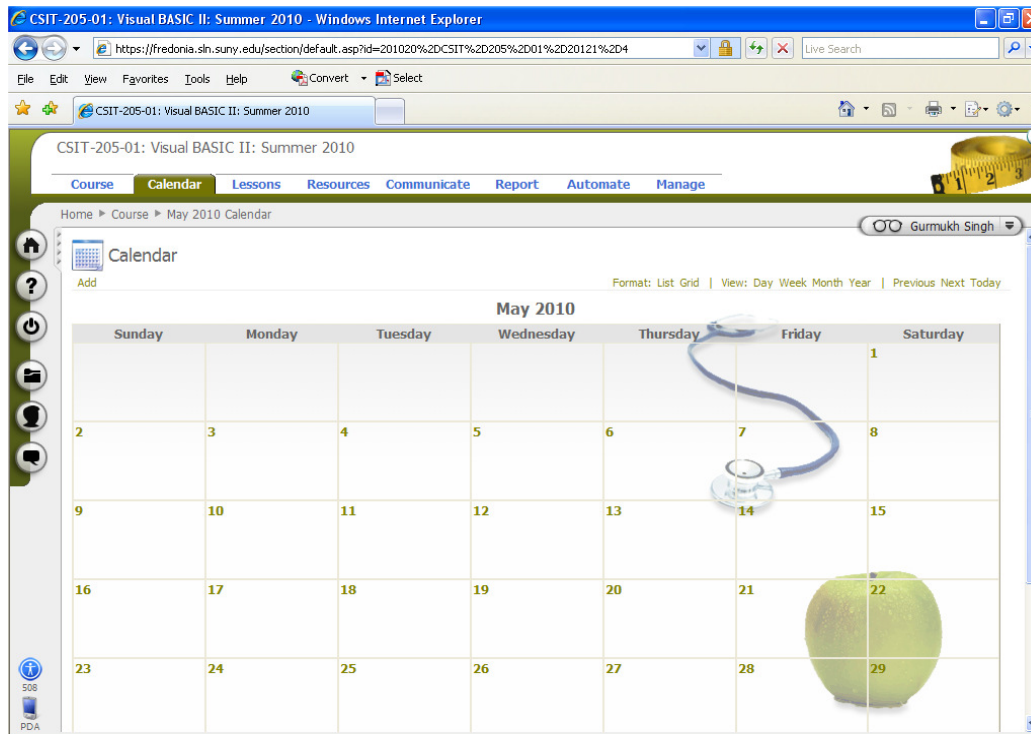


Figure 3. An actual Screen-shot of ANGEL "Calendar" Tab

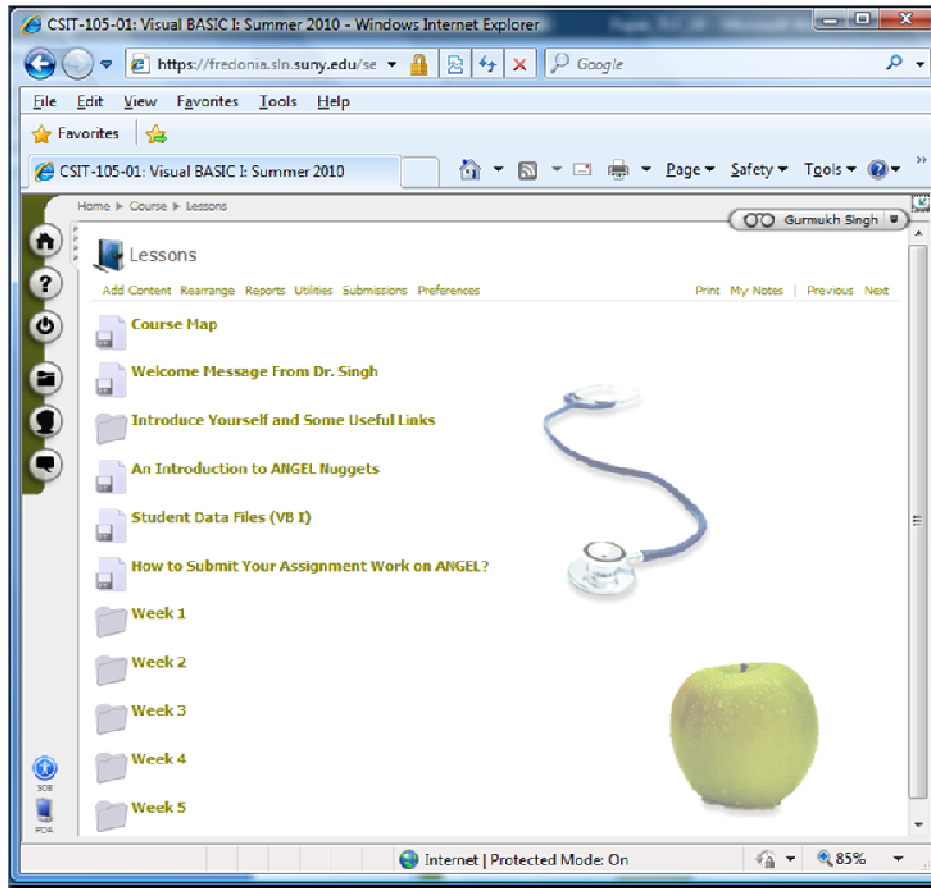


Figure 4. An actual Screen-shot of ANGEL “Content” or “Lessons” Tab

Section” and “Group Resources” windows. Its screen-shot is shown in **Figure 5**. In “About This Section” window, there is a welcome message from an instructor for the students. Students are instructed to go through it to know their course instructor. The other window “Group Resources” contains two lists of items: “Communication Links” and “Useful Links”. It is possible that list of items in these two links may be hidden. If so, one has to click on + on left-hand-side of each link to open each list of items. Communication Links has five options: using one of them, students can have communication with their instructor. An instructor may point out to his/her students the preferred mode of communication options to be used. In case students do not have an access to these preferred communication options, they are allowed to use rest of three communication links to reach an instructor. Useful Links could be used to access university library resources and some other useful information that can be obtained from textbook’s publisher website, e.g., students may download student data files for a given course and can also download lecture notes in a crude format. Usually, these lecture notes are extensively modified by instructors for teaching purposes.

“Communicate” Nugget

The fifth tab in ANGEL GUI is known as “Communicate” Tab, which will have five windows, e.g., (i) Group Mail, (ii) Group Roster, (iii) Group News and Events, (iv) Discussion Forums and (v) Communication Links windows. Students can send an email to an instructor using college/university ANGEL server. Its screen-shot is shown in **Figure 7**. In general, students will get emails from the instructor through ANGEL server for a course work. Instructor may direct his students to check their “View Inbox” daily once or twice to see if there is a new email from instructor regarding some important course information.

“Report” Nugget

The next Tab on ANGEL GUI is called “Report” Nugget, which is shown in **Figure 8**. “Report” Tab provides access to several reports, which can help an instructor to track down student progress in the course work. A student can do the same thing too. It is composed of two windows. In

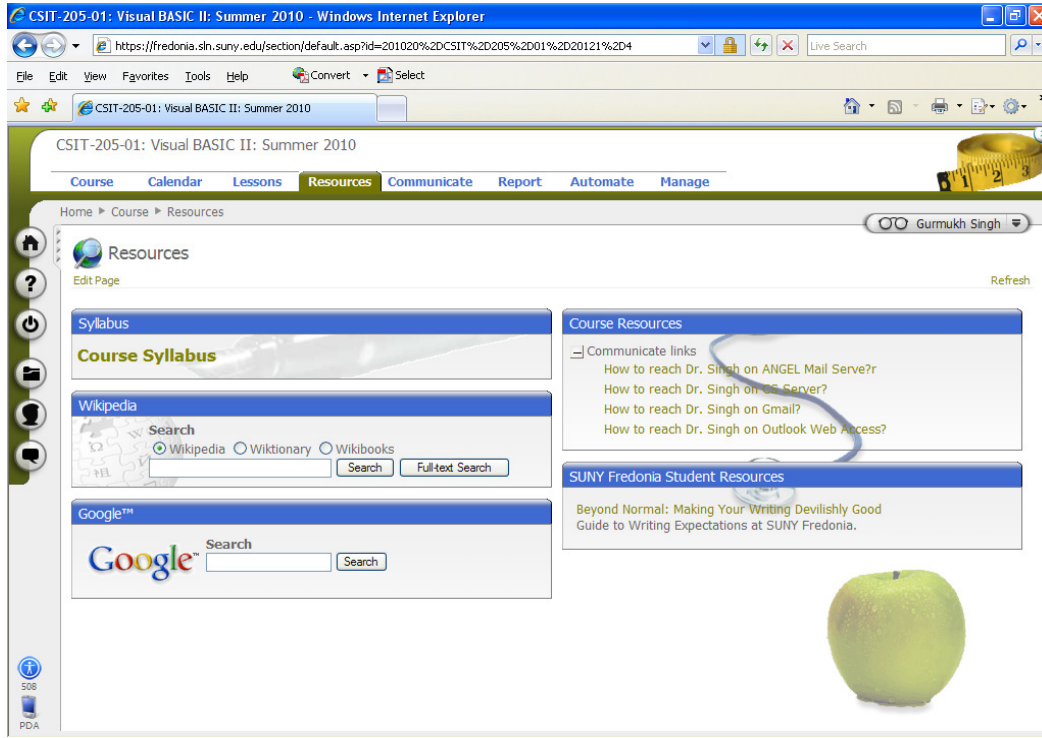


Figure 5. An actual Screen-shot of ANGEL “Resources” Tab

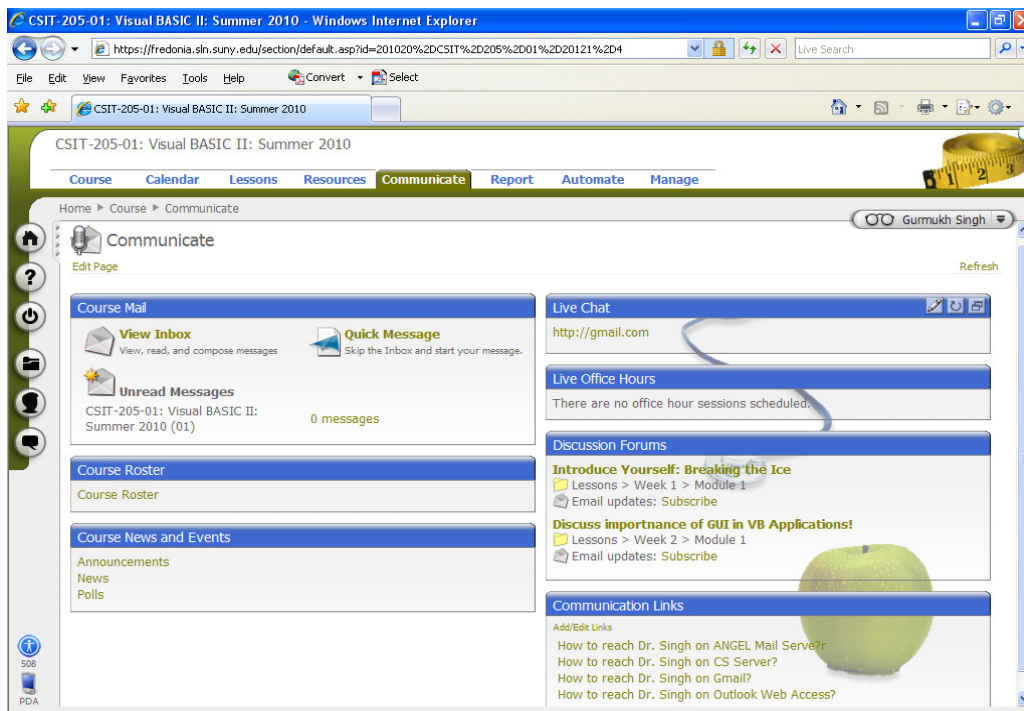


Figure 7. An actual Screen-shot of ANGEL “Communicate” Tab

the left side window, one of the four options can be displayed at a time: (i) Map (ii) What is New, (iii) Tasks

and (iv) About. Right now in Figure 8, option “Map” is high-lighted, which means the first item can be seen in

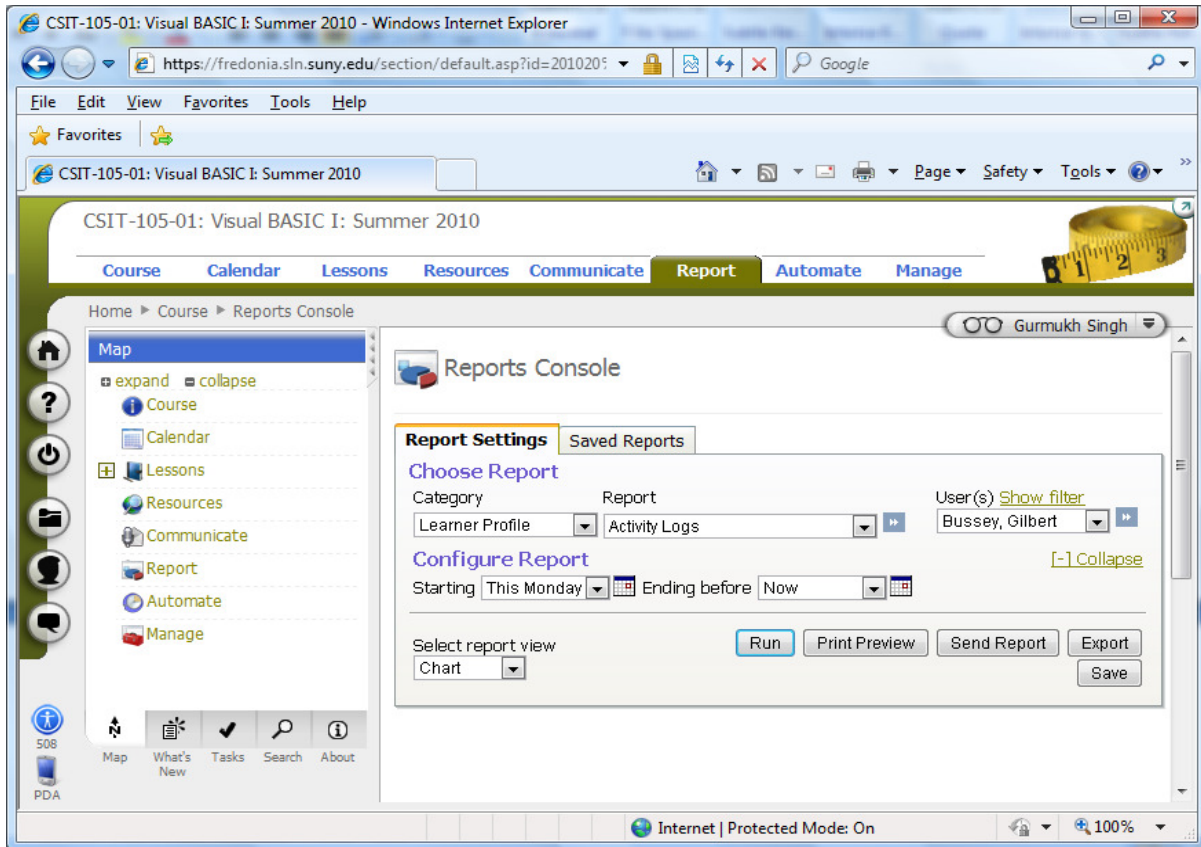


Figure 8. An actual Screen-shot of ANGEL “Report” Tab

the first window. Here, “Map” actually shows ANGEL eight Tabs or Nuggets map. One has to be clear that it is not the Course Map of an online course. By clicking one of the remaining three options, it is possible to explore what is being done by each option. The right-hand-side window is called “Report Console” window. ANGEL’s Reports Console provides a wealth of data-mining provisions in a single central location, which allows instructor flexibility with a full range of report options in a simple console interface that makes selecting components easy. An instructor can track all aspects of an individual learner, class, milestone, or specific content item with the Reports Console. Reports Console can be set in two modes: (a) one is a default mode called “Report Settings” and (b) the other one is called “Saved Report”. The default “Report Settings” is further subdivided into two parts: (1) Choose Report and (2) Configure Report. The default report includes the following seven-item list: (i) Learner Profile, (ii) WhoDunIt, (iii) Class, (iv) Content, (v) Grades, (vi) Milestones, and (vii) Learning Outcomes. A brief explanation of each item is given below:

“Learning Profile” offers a unique opportunity to an instructor to know learner’s performance measures and statistics. This report enables the instructor to see a

particular student’s profile and give the student information on his/her performance in comparison to the class averages. “Who Dun It” compiles reports of a student who did or did not finished a particular item, logged into the course environment since a specific date, and more. This report allows an instructor to email students who appear in the report at the touch of a button. “Class” provides reports on user activity such as activity logs, attendance, submissions, and consequently, provides a quick view of student progress in a course, allowing an instructor to take necessary action, if any. “Content” gives an access to activity details and activity summaries, which provide the instructor information on how many times a student accessed an item and an activity log of the item. Item analysis shows a summary of responses by question of a quiz or survey. Student logs and submission information is also available under this report. “Grades” provides an access to student grades without accessing the Grade book. “Milestones” is a list of items that have been assigned a milestone and a legend indicating student progress. “Learning Outcomes” provides reports for objectives that are mapped to content or standards that are mapped to content. This provides an overview of the standards or objectives mapped to the content with the number of items meeting

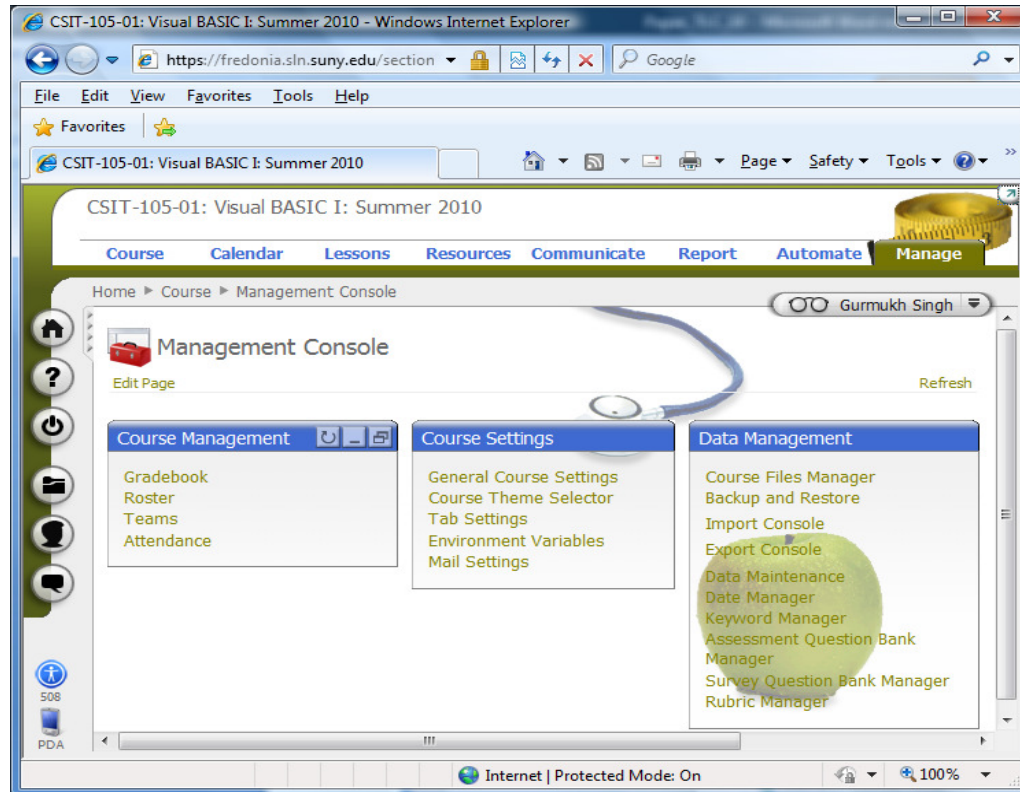


Figure 9. An actual Screen-shot of ANGEL “Manage” Tab

the standard/objective, the content type, and the name of the content-item. For more details on Report Tab, one may refer to (ANGEL® 7.3 Instructor Quick start Guide (2008). ANGEL Learning Inc).

“Manage” Nugget

The last Tab on ANGEL GUI is called the “Manage” Nugget, which is shown in Figure 9 and is composed of three windows: (i) Course Management, (ii) Course Settings and (iii) Data Management. Course Management window has the following four links: Grade book, Roaster, Teams and Attendance. The most important link according to our opinion is Grade book, which an instructor is required to link with Assignment, Quiz, Exam Drop Boxes or Assessment Editor in case an Exam/Quiz is created using that kind of editor. Grade Book will not show the student letter grades unless an instructor does plug-in grade range corresponding to each letter grade. To do that one has to first click on “Grade book” to open “Grade book Management” window in which an instructor has to set up the “Grading Scale”. An actual screen-shot of “Grading Scale” of CSIT105 course during summer of 2010 is displayed in Figure 10, where letter grade corresponding to each score rage is shown. We may mention here that student grades can

be imported directly into ANGEL Grade book from the Excel Spread sheet.(www.sakaiproj.org, available on 31/03/2011).

“Course Settings” window has the following five options: (Shively and Ketcham, 2009) General Course Settings, (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx) Course Theme Selector, (Rizopoulos and McCarthy, 2009) Tab Settings, (Allen and Seaman, 2007) Environment Variables and (www.ibm.com/developerworks/lotus/library/ls-NDHistory/available on 31/03/2011) Mail Settings. The last window in Manage Tab is called “Data Management”, which has several database management options as listed below: (Shively and Ketcham, 2009) Course Files Manager, (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx) Backup and Restore, (Rizopoulos and McCarthy, 2009) Import Console, (4) Export Console, (www.ibm.com/developerworks/lotus/library/ls-NDHistory/available on 31/03/2011) Data Maintenance, (Curtin, 2002) Date Manager, (www.moodle.org available on 31/03/2011) Keyword Manager, (www.sakaiproj.org, available on 31/03/2011) Assessment Question Bank Manager, (Singh and Siddiqui, 2009) Survey Question Bank Manager and (10) Rubric Manager. Any instructor who is interested to learn more about the above

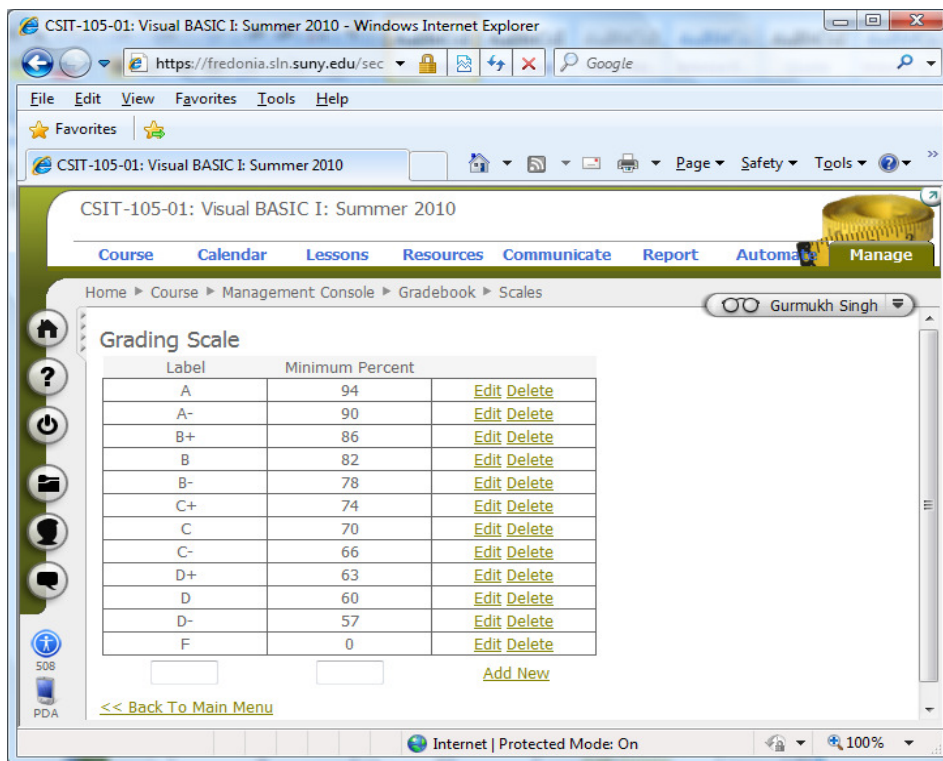


Figure 10. An actual Screen-shot of ANGEL “Manage” Tab

mentioned options is referred to Instructor Quick start Guide (ANGEL® 7.3 Instructor Quick start Guide ,2008).

Submit Your Assignment Files on ANGEL” is depicted in Figure 11. Any instructor who needs a hard or soft copy of this handout from me is most welcome.

Student Data Files

For freshman and sophomore level courses taught in Department of Computer and Information Sciences, it is a common practice to post student data files on ANGEL or a local CS server. Students may have an access to student data files from publisher’s website. It is important to point out here that before uploading student data files on ANGEL sever, one should always zip them to save space. Of course, students will have to unzip them before they can use them for their course work. It is possible that many instructors from several departments may not need student data files for teaching their online courses, and therefore, for those instructors the creation of this Module is not mandatory.

How to Submit Your Assignment on ANGEL

Some students always encounter a difficulty in uploading their completed assignment work on ANGEL server, therefore it is very essential to post instructions for the convenience of your students, which can be done right here in this Module. An actual screen-shot of “How to

Week 1

For the first week of a summer course in Fredonia, students are supposed to go through a main Module called Week 1. For rest of the four weeks, the corresponding four main Modules are Week 2, Week 3, Week 4 and Week 5. Each main Module like Week 1, Week 2, Week 3, Week 4, Week 5, is further subdivided into two Sub-Modules: Module 1 and Module 2. A screenshot sub Module 1 is shown in Figure 12. It must start with a list of items or materials required for a given course work. Sub Module 1 also contains three folders: (Shively and Ketcham, 2009) Welcome Message from Dr. Singh (your course instructor), which may be skipped as it did exist in Course Map. (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx) Course Map here is, once again, a repetition and that can also be easily avoided. (Rizopoulos and McCarthy, 2009) The third folder is the Course Syllabus. Please ask your students to read it very carefully as all major course policies are explained in it. Further, Course Syllabus can be downloaded by your students. By going through the

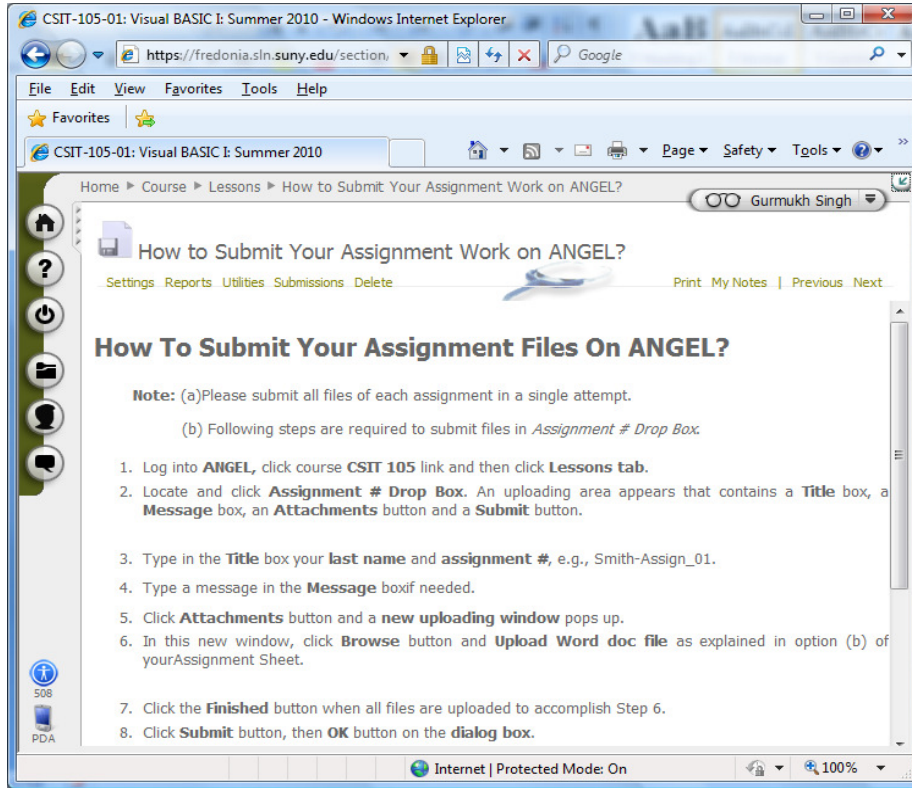


Figure 11. A screen-shot of instructions "How to Submit Your Assignment Files On ANGEL"

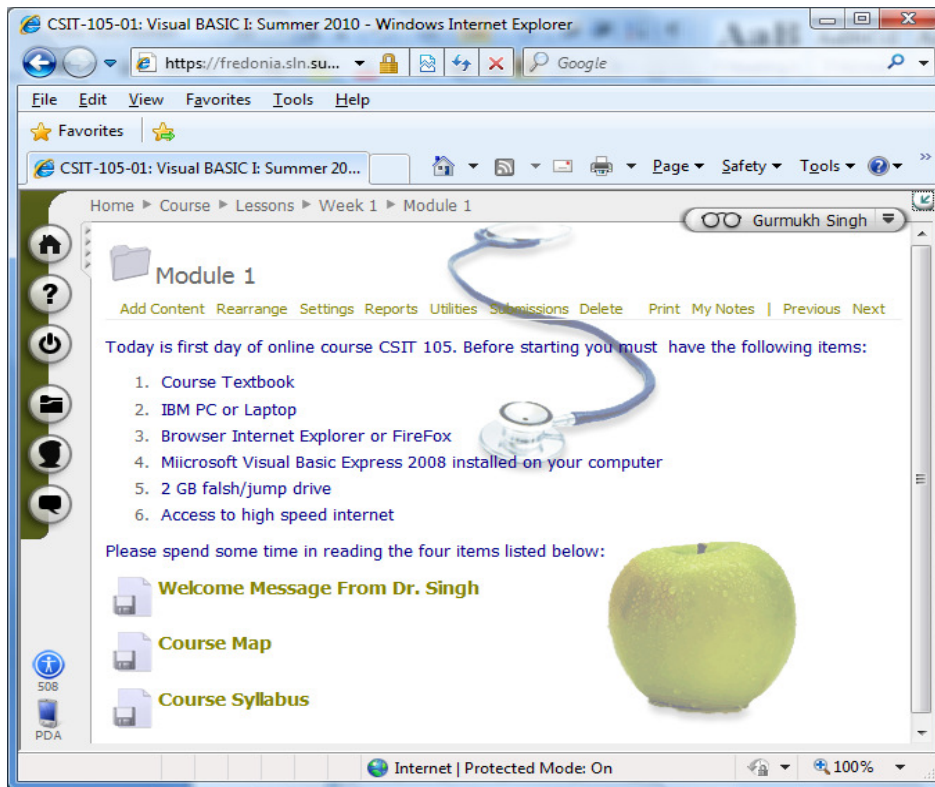


Figure 12. A screen-shot of Module 1 of Week 1

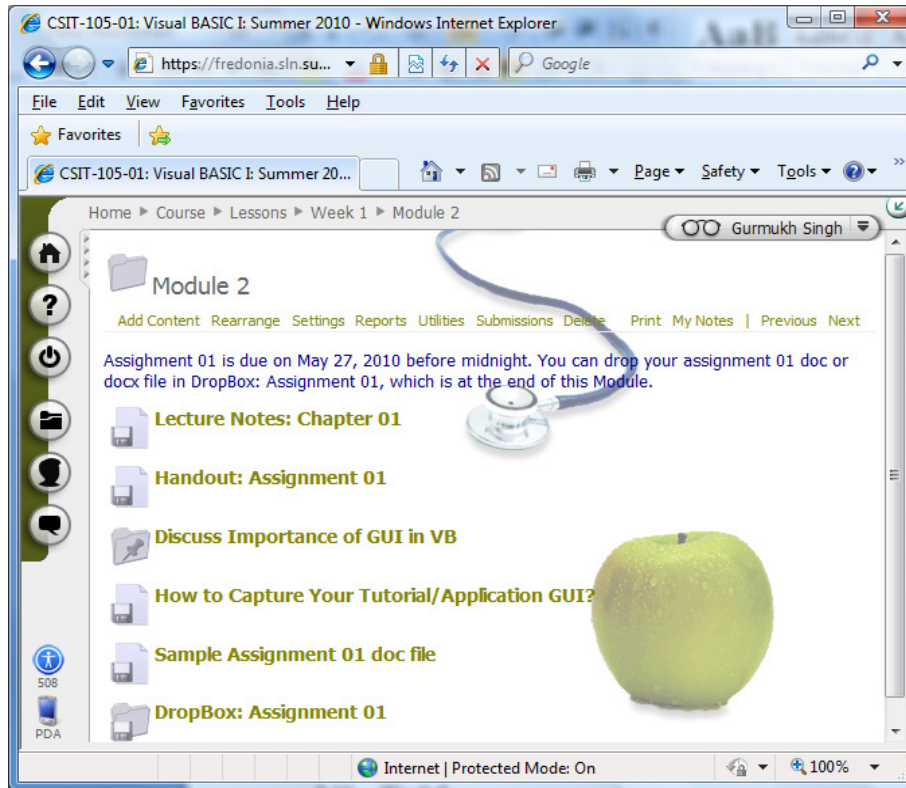


Figure 13. A screen-shot of Module 2 of Week 1

Course Syllabus, students will have a good feeling about what is to be done and on what date etc. They would be able to figure out the textbook to be used and what kind of grading scale is to be used to assign the letter grades etc.?

It is very important to provide before-hand information to the students about something to be done once they open a given Module or sub Module, otherwise there is an ample chance that they may miss an important due date of an assignment altogether or the date of a scheduled quiz/Exam. Therefore, sub Module 2 (see also [Figure 13](#)) begins with an announcement that indicates the due date of Assignment 1, and where this assignment is to be dropped or handed in. Sub Module 2 is composed of six items/links: (Shively and Ketcham, 2009). Lecture Notes of Chapter 01 in power point format. (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx) Handout of Assignment 01 in MS Word doc or pdf format, (Rizopoulos and McCarthy, 2009) A Discussion Forum to Discuss Importance of GUI in VB Applications, but the last item is not mandatory for this course work as no points are assigned to it. If so, it can be linked with ANGEL Grade Book. (Allen and Seaman, 2007) This item presents instructions for "How to Capture Your Tutorial/Application GUI?" (www.ibm.com/developerworks/lotus/library/ls-NDHistory/ available on 31/03/2011) Guidelines for the

students to create a MS doc/docx file of their assignment work, e.g., Sample Assignment 01 doc/docx file is linked so as to give a feel to the students how does their assignment look like. We hope with this sample assignment handout, students will have the least amount of difficulty to create it and submit it in ANGEL server. (Curtin, 2002). The last item in this sub Module is a Drop Box in which doc/docx file of Assignment 01 could be submitted.

Two sub Modules corresponding to each of the remaining four weeks, Week 2, Week 3, Week 4, and Week 5, have the same basic structure as discussed for Week 1. However, there are three online quizzes to be taken by our students. These three quizzes are generated using Assessment Editor. For the convenience of instructors a screen-shot of how to create a relevant item on ANGEL is presented in Figure 1. One can easily have a glance on the several different items that can be added in one's online website in a given sub Module. Even students can do the online evaluations of an instructor using the Survey Editor. An instructor may use the official survey questions from the bubble sheet supplied by University administration or an instructor may design his/her own survey questions. We believe giving online quizzes and Exams on ANGEL would be a very versatile and convenient way of doing these things by the instructors who are interested to switch from F2F to online

Table 1. This table indicates each question's point score depending upon student's response

Serial #	Kind of Student Response	Response Score
1	Strongly Agree	5.00
2	Agree or Exceedingly Good	4.00
3	Neutral (neither agree nor disagree)	3.00
4	Disagree	2.00
5	Strongly Disagree	1.00

Table 2. A brief description of each question statement used in the current rubric used for the F2F student's response

Question #	Question Statement
1	Did posting of my Lecture Notes, Lab Assignments, Student Exams files, due dates of Lab Assignment on ANGEL Calendar, Course Announcements on ANGEL website facility help you in any way to learn this CSIT course?
2	Did creation of Drop Boxes for Exam Projects and Lab Assignments on ANGEL facility or emailing directly to your instructor through ANGEL email server or sliding in Dr. Singh' Office convenient way to hand-in the completed Exam Projects and Lab Assignments concerning this course work?
3	Did my help during class-time in completing Lab Assignments and PowerPoint Lecture Notes posted on ANGEL or on my computer science (CS) website useful for this course work?
4	Did emailing of Exam Date, Time, and other relevant course information help you not to miss any of the course Exams and Exam Projects?

teaching/learning methodology.

COURSE DESIGN FROM STUDENT'S PERSPECTIVE AND RESULTS

Unless the course design is not tested from the perspective of students, it is not possible to comment on its effectiveness for teaching/learning purposes. For this reason, we created a simple rubric with a set of four questions and took the survey of four different F2F classes of the Department of Computer and Information Sciences. **Table 1** shows a brief description of each question statement used in the present survey rubric. One of the authors taught four different courses to the students, and collected the data corresponding to the cited four questions. Each question was assigned a numerical score ranging from 1.00 through 5.00, which means there were five categories of score. Table 1 depicts each kind of student response along with its numerical score. The maximum score is 5.00, which corresponds to "Strongly Agree" student response, whereas the least score of 1.00 is due to student's response "Strongly Disagree". For rest of the three student responses, one may refer to Table 1 for their point value.

Table 2 displays the statement of each of four questions used in the present rubric. We used these four questions in order to determine the student response of four F2F classes taught in the Department of Computer and Information Sciences, SUNY Fredonia.

To figure out the effectiveness of the designing technique employed, each data sample of students was selected from three categories: freshman, sophomore and junior, and their collected survey data are presented in **Table 3**. In this Table, we also included the number of students who participated in the evaluation survey data for a given course. It is clear from Table 3 that in all the four different F2F classes taught in the Department of Computer and Information Sciences, the overall average score for each of the four questions is not so widely different. In particular, if one examines very carefully overall average score for CSIT 205 course, one finds that it is approximately equals 5.00. This proves that the way the course set-up was designed on ANGEL server, the sophomore student's response to the teaching/learning methodology is very likely "Strongly Agree". For the two freshman level classes (CSIT 104 and CSIT 105), the student response is much better than "Exceedingly Good or Agree", whereas for a junior level class (CSIT 321), the response is a little more than "Exceedingly Good or Agree". These results are quite encouraging and interesting to extend the current analysis work onto recently taught online courses by one of the authors in Department of Computer and Information Sciences (Student evaluation data collected using online "Survey Editor" of ANGEL course management system during J-Term and Summer Sessions of (2010-2011) in the Department of Computer and Information Sciences, SUNY Fredonia, NY).

To strengthen further and test the validity of effectiveness of our online e-learning methodology and

Table 3. Results of statistical analysis of survey data collected for four different F2F classes taught by authors during past three years (Student evaluation data collected using F2F teaching methodology in the Department of Computer and Information Sciences (2006-2009) SUNY Fredonia, NY, during past three years)

Course Name and Number of Students	Average Score for each Question out of 5.00 Points			
	CSIT 104 (86)	CSIT 105 (39)	CSIT 205 (29)	CSIT 321 (10)
Question # 1	4.36	4.34	4.73	4.00
Question # 2	4.12	4.25	4.73	4.50
Question # 3	4.36	4.10	4.69	3.67
Question # 4	4.50	4.24	4.62	4.17
Overall Course Average	4.34	4.23	4.69	4.09

Table 4. A comprehensive rubric to investigate the online student response during J-Term and Summer Sessions, 2010-2011

Question #	Question Statement
1	Did posting of my Lecture Notes, Lab Assignments, Student Exams files, due dates of Lab Assignment on ANGEL Calendar, Course Announcements on ANGEL website facility help you in any way to learn this CSIT course?
2	Did creation of Drop Boxes for Exam Projects and Lab Assignments on ANGEL facility or emailing directly to your instructor through ANGEL email server convenient way to hand-in the completed Exam Projects and Lab Assignments concerning this course work?
3	Did answering of your questions regarding this course work through ANGEL email facility help in completing your Lab Assignments? Did my PowerPoint Lecture Notes posted on ANGEL website useful for this course work?
4	Did emailing or posting of Exam Date, Time, and other relevant course information help you not to miss any of the course Quizzes/Exams and Exam Projects?
5	Did you like basic design/setup of my online website on ANGEL server?
6	Do you recommend this online course to other students?
7	Was it convenient for you to appear in course Exams/Quizzes online on ANGEL server any time during the Exam/Quiz day and should I continue exactly the same way for future online courses?
8	Did I promptly answer all of your questions regarding this course work?
9	What is your overall rating of this online course?
10	Would you like to take another online course with this instructor?

its delivery using ANGEL server, we created a comprehensive rubric with a set of ten questions and requested the students to participate in survey of five different online courses (CSIT 151, CSIT 105, CSIT 205, CSIT 107, and CSIT 207) taught during J-Term 2010, 2011, and Summer 2010, 2011 Sessions in the Department of Computer and Information Sciences. **Table 4** displays a brief description of each question employed in the online survey rubric. It may be worthwhile to mention here that each survey was created using the ANGEL "Survey Editor" in which it is possible to add various kinds of questions: Multiple-Choice, Multiple Select, Likert Scale, Short Answer and Essay type. In the present work, we employed Likert Scale to add questions to the survey rubric because it provides users with a question followed by a scale of choices, optionally including a grid of sub-questions. Another advantage of "Survey Editor" is that it could tabulate and plot the results of a given online survey automatically once a

student had completed it.

As mentioned before, very recently, we taught five online courses during J-Term 2010, 2011 and Summer Sessions 2010, 2011 in SUNY Fredonia (Student evaluation data collected using online "Survey Editor" of ANGEL course management system during J-Term and Summer Sessions of (2010-2011) in the Department of Computer and Information Sciences, SUNY Fredonia, NY). Raw data sample of six students who took CSIT 151 online course during Summer Session of 2011 is presented in **Table 5**. This table shows frequency distribution of student's response corresponding to each question out of a total of ten questions. It is surprising to note down that none of the students response is Disagree/Strongly Disagree. Therefore, column for "Strongly Disagree" response is omitted from Table 5. Total score of each question and its average is displayed in column seven and eight, respectively. To save space, raw data collected on the frequency distribution for rest of

Table 5. Raw data sample collected for CSIT 151 online course taught in summer of 2011 (Student evaluation data collected using online “Survey Editor” of ANGEL course management system during J-Term and Summer Sessions of (2010-2011) in the Department of Computer and Information Sciences, SUNY Fredonia, NY)

CSIT 151		Frequency of each question response				Total Score	Average Score
Sr #	Question #	Strongly Agree	Agree	Neutral	Disagree		
1	Question 1	6	0	0	0	30	5.00
2	Question 2	6	0	0	0	30	5.00
3	Question 3	3	3	0	0	27	4.50
4	Question 4	4	2	0	0	28	4.67
5	Question 5	5	1	0	0	29	4.83
6	Question 6	4	2	0	0	28	4.67
7	Question 7	5	1	0	0	29	4.83
8	Question 8	5	1	0	0	29	4.83
9	Question 9	4	2	0	0	28	4.67
10	Question 10	5	0	1	0	28	4.67
	No. of Students	6				Overall Average	4.77

Table 6. Results of statistical analysis of survey data collected for five different classes taught during J-Term and Summer Sessions 2010-2011 (Student evaluation data collected using online “Survey Editor” of ANGEL course management system during J-Term and Summer Sessions of (2010-2011) in the Department of Computer and Information Sciences, SUNY Fredonia, NY)

Course Name and Number of Students	Average Score for each Question out of 5.00 Points					Overall Row Average
	CSIT 151 (6)	CSIT 105 (19)	CSIT 205 (5)	CSIT 107 (8)	CSIT 207 (8)	
Question # 1	5.00	4.58	4.50	4.63	4.38	4.62
Question # 2	5.00	4.68	5.00	4.75	4.88	4.86
Question # 3	4.50	4.84	5.00	4.50	4.63	4.69
Question # 4	4.67	4.58	5.00	4.88	4.75	4.78
Question # 5	4.83	4.42	4.75	4.63	4.75	4.68
Question # 6	4.67	4.47	4.75	4.75	4.63	4.65
Question # 7	4.83	4.68	4.25	4.75	4.63	4.63
Question # 8	4.83	4.79	5.00	4.63	4.88	4.83
Question # 9	4.67	4.47	5.00	4.88	4.75	4.75
Question # 10	4.67	4.79	5.00	4.75	4.88	4.82
Overall Average	4.77	4.63	4.83	4.71	4.71	-

the four online courses (CSIT 105, CSIT 205, CSIT 107, and CSIT 207) is not listed here. Just like creating a student survey using “Survey Editor” for each online course, we designed all the online tests/quizzes using “Assessment Editor” of ANGEL server. Main advantage of creating online tests/quizzes was that students could appear in a given test/quiz at any time during 24/7. The ANGEL server instantaneously graded and plotted the student score once he/she has submitted it with a single click of mouse.

Results of the statistical analysis performed on the data collected through these five online courses are depicted in Table 6. In second row of this table, column two through six lists the course number, e.g., CSIT 151, CSIT 105, CSIT 205, CSIT 107, CSIT 207, and the number of

students (shown within parentheses) who took part in the present online survey. One can easily perceive that overall average score of each question for all the online courses in the last column of Table 6 or overall average score of each course for all the questions in the last row of Table 6 is very near to 5.00, which indicates that our teaching/learning technique on ANGEL server is really effective in imparting the instruction delivery to the online students.

To give a different flavor to the online data collected from student surveys of five online courses, it is good idea to graphically plot in Fig. 14(a) the overall average score as a function of course number using all the ten questions listed in first column of Table 6 for each online course taught. We now fit a least-squares trend-line

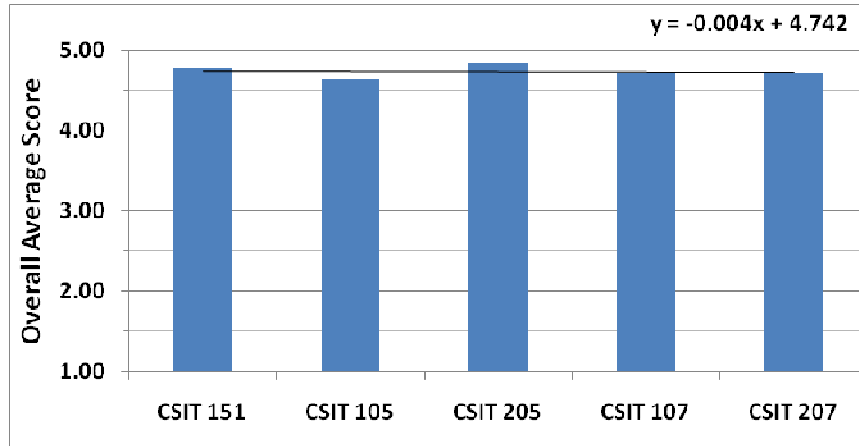


Figure 14a. A plot of overall score of all ten questions for each of the five online courses

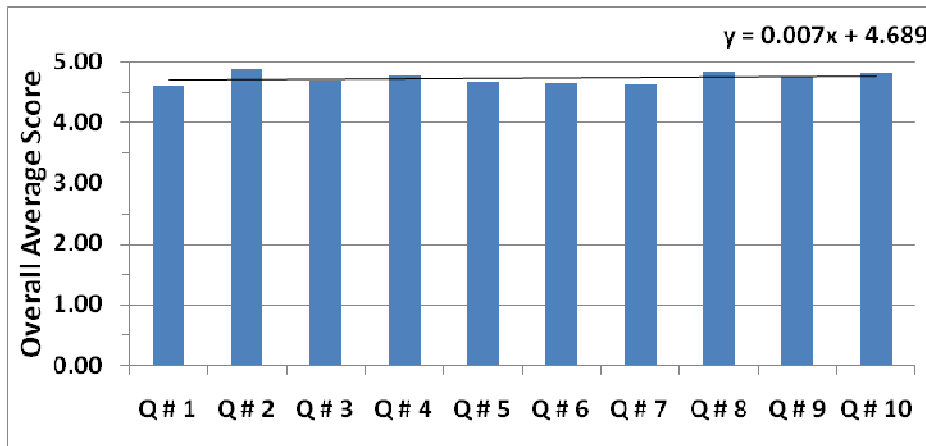


Figure 14b. A plot of overall average of each question listed in a given row of Table VI for all the five online courses

through the data shown in **Figure 14(a)**. The linear best-fit line through the data points is: $y = -0.004x + 4.742$. From this best-fit equation, it is clear that the intercept of trend-line is 4.742, which is a direct measure of effectiveness of the online course technique used in the present work and this value of intercept is very close to 5.00, indicating that a great majority of online students have response very nearly “Strongly Agree”.

Similarly, we plot in **Figure 14(b)** overall row average of each question, listed in a given row of Table 6, as a function of question number for all the five online courses. Exactly the same way as was done in Figure 14(a), we fit a least-squares trend-line through the data presented in Figure 14(b). The equation of linear best-fit line through the data points is: $y = 0.007x + 4.689$. From this equation, it is clear that the intercept of trend line is 4.689, which once again is a direct measure of effectiveness of the online course technique developed

by us. This value of intercept 4.689 nearly equals to 5.00 indicates that a vast population of student response is “Strongly Agree”. Therefore, in both cited cases it can be seen that intercept of a least-squares fitted trend line is very close to 5.00, and consequently it supports the conclusion that our online e-learning model or technique is very effective in imparting the instructions to online students of five different Computer and Information Sciences courses taught in SUNY at Fredonia. Thus, we conclude that instructors from other educational institutes like SUNY Fredonia may employ our e-learning model in their online course delivery.

CONCLUSION

In the current article, we have successfully developed, on ANGEL server ([www. blackboard. Com / Teaching-](http://www.blackboard.com/Teaching-)

Learning/Learn-Resources/ANGEL-Edition.aspx), a basic e-learning model for an effective teaching of F2F/online courses in the undergraduate classroom setting at freshman, sophomore, junior and senior level, which we believe would be appreciated by the university and college faculty. The same course design model could be employed effectively for teaching/learning graduate students in universities and colleges.

We have presented many useful and innovative guidelines in the course designing process, which could encourage the instructors who have a keen desire to switch over from traditional F2F to online teaching/learning methodology. One of the important points to design an online course is to split up the course structure into several main modules, e.g., for a two-week J-Term course it must have two main modules in which the entire course material sits, whereas for five-week summer course, the number of such main modules has to be five (e. g., see Course Map for a five-week summer course in Figure 4). It is very important to give actual screen-shots of Course Maps, and of all the Nuggets being used in an F2F/online course so that an instructor will have a pretty good mental picture of how to proceed with the creation of an effective course website on ANGEL course management system. Consequently, we discussed almost all the ANGEL Nuggets in the effective course design model and for its delivery, e.g., “Calendar” Nugget to post course announcements, “Lessons” Nugget to post power point lecture notes embedded with audios or videos, homework assignment handouts in doc/docx or pdf format, creation of Drop Boxes to submit completed assignment work and quizzes/exams, creation of quizzes/exams with help of ANGEL “Assessment Editor”, which could provide an instantaneous access to the student grades, its statistical analysis and graphical form, and thus, saving instructor’s time to do manual grading of quizzes/exams. “Resources” Nugget is used to upload the course syllabus and to establish links to other internet resources concerning a particular course work, such as google.com, wikipedia.com etc. “Communicate” Tab can be used to establish a communication link among course students and their instructor. Here, students can have a live online chat with other classmates or a discussion with the peers using Discussion/Threaded Discussion Forum (www.blackboard.com/Teaching-Learning/Learn-Resources/ANGEL-Edition.aspx) so as to indulge in collaborative learning. “Report” Tab provides an access to several kinds of reports, which can help an instructor to track down his/her student’s progress in the course work. A student can also do the same thing. With “Manage” Tab, instructors are able to create an electronic Grade Book and a student can easily check his/her weekly progress in the course work by running the Report. Finally, an instructor can get his/her evaluations done by the students with the help of “Survey Editor”, which can tabulate collected data instantaneously.

We tested the usefulness of this effective course design technique with the help of actual data collected in the Department of Computer and Information Sciences from four F2F courses (Student evaluation data collected using F2F teaching methodology in the Department of Computer and Information Sciences (2006-2009) SUNY Fredonia, NY, during past three years) and five online courses (Student evaluation data collected using online “Survey Editor” of ANGEL course management system during J-Term and Summer Sessions of (2010-2011) in the Department of Computer and Information Sciences, SUNY Fredonia, NY) taught in J-Term and Summer Sessions, 2010, 2011. We found an exceedingly good student response for F2F courses taught by authors, and an excellent response for online courses. We believe similar, positive and encouraging results would be obtained by instructors of Computer Science Department in SUNY Fredonia and of other universities/colleges, who are planning to teach newly designed online courses on ANGEL course management system in the very near future.

ACKNOWLEDGMENTS

Dr. Singh is thankful to Madam Lisa N. Melohusky, Instructional Design Specialist, Professional development Center, SUNY Fredonia, NY and Dr. Sharon Zabloutney, Department of Biology, SUNY Fredonia, NY, for their comments, criticism and suggestions on the designing technique of his online courses on ANGEL server. Dr. Singh is also thankful to Dr. John Kijinski, Dean of College of Arts and Sciences, Dr. Shell Beez, Director of Professional Development Center, and Dr. Reneta Barveva, Chair, Department of Computer and Information Sciences, SUNY Fredonia, NY, for financial assistance to attend the CIT-2011 Conference held at SUNY Oneonta, NY.

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