

An Outcome-Driven Online Graduate Course: Real Time Systems Course

Subramaniam Ganesan
ganesan@oakland.edu

Type of Strategy: Teaching strategies for online courses are naturally different from traditional teaching in a regular class room. In this paper we explain the techniques used to increase students interactions in an online course. Normally a course has five or six outcomes or objectives. We expand it to fourteen outcomes and re-arrange the course material so that each week the course material for one of the outcome can be taught. Students do assignments related to the weekly outcome so that we can assess whether the students met the outcome. If necessary more feedback is given so that the students can meet the outcome expected. This paper presents the outcome for a graduate online course on "real time systems." The course coverage is re-organized to meet the weekly outcome.

Purpose, Goal(s) or Learning Outcome(s) for Strategy

Measurement of the weekly outcome

The weekly homework assignments, monthly tests, group discussions on the forum, mid-term paper presentation on the Moodle, and final project and presentation, are used to measure the weekly outcomes. The grading and tests are similar to a regular graduate course. The quality and quantity of the material taught in the online course is identical to that taught in a class room based course. Since we monitor and assess the course outcome every week the outcome based online course meets the course objectives much better than the traditional course. In an online course, some students put in less effort some weeks, and barely meet the overall course objectives. In our method of weekly outcome based online course, the students are monitored for the outcome every week and they tend to meet all the weekly outcomes.

Assessment of outcomes

A simple survey questionnaire listing the weekly outcomes were given to the students and the feedback is collected. At the end of the course the survey for course objectives were given. The students taking the outcome based course met the course objectives much more than that of the traditional course. The problem solving skills and critical thinking skills¹⁹⁻²⁰ for the students are especially developed well since they are emphasized every week indirectly when we design the course for weekly outcome.

Type of Course: Graduate online course.

Typical Number of Students in Course: 20

Name of Course: ECE 666 Real Time Systems

Ease in which strategy could be modified and/or applied to other courses: Easy

Brief Overview of Strategy

The weekly assignments develops skills like, Creativity, What-if analysis, Problem-solving and Critical thinking. Critical thinking involves questioning the assumptions and normal solutions and encourages

finding alternative/ better solutions. Students communicate with the teacher or communicate with other students during the week to clarify and understand the material.

Student Forum in the Moodle provides a method for students to communicate. The instructor monitors the discussion in the "Forum" to give his/her input and provide leading questions to direct the students towards the right answer.

To meet the weekly outcome

Create a weekly course work and assignments that outlines specific and measurable outcomes for every week. Consider individual needs of students and make sure that the outcomes are met by all. Provide challenging questions to high performing students and give them higher points.

Student's abilities and skills differ. Their pre-requisite course knowledge affects their performance in the current course. We test the basic pre-requisite knowledge expected from the registered students during the first week of the course and provide necessary feed back to the students.

Step-by-Step Instructions of Strategy

Real Time System Course Outcome

- Know the definition and characteristics of Real Time systems
- Know the various task assignment and scheduling methods. For example RM and EDF scheduling.
- Become familiar with Real Time system development tools like Matlab RT tool box, ETAS tools
- Know the important characteristics of Real Time Operating System,
- Know about the RT System requirement, design, and performance analysis.

Weekly Outcomes

Week 1: Know the characteristics of Real Time systems- Soft, Hard, Hybrid systems. Recollect the pre-requisite material- Embedded systems characteristics and basic design.

Week 2: Know the definitions of various terms in Real Time systems and discussions on real time system design issues. Hardware design issues for RTS.

Week 3: Know the Characteristics of Real-Time-Operating –System (RTOS), various RTOS available in the market. Basic concepts of task scheduling: Clock driven, Priority driven, RM scheduling, EDF scheduling and others.

Week 4: Know the various real time software tools and their applications. Matlab Real time tool box (Simulink coder), ETAS tools like Intecrio and ASCET for simulating real time scheduling. Free tools as add on to Matlab for testing Schedulability and graphing the time line.

Week 5: Know the challenges and solutions for "Dead lock and Live lock". Use of UML to support Real time system design stages.

Week 6: Know the use of UC/Cos real time operating system details and use for a simple application.

Week 7: Know the details of the following: Slack stealing, fast slack stealing, priority inversion blocking, how to use priority inheritance, priority ceiling protocol, resource sharing, direct blocking, push through blocking, resource management.

Week 8: Make a presentation using power point on one of the advanced issues or topics in real time systems. Submit on the Moodle audio embedded on power point. These slides will be viewed by other students and questions are asked using Moodle "Forum". The questions and answers are viewed by all the students. This activity increases more interaction between students.

Week 9: Know the challenges and details of real time communication: CAN protocol, Ethernet protocol.

Week 10: Know the details of Real time data bases and applications.

Week 11: Know how to use Cheddar software tools to perform timing simulation and analysis of RTS.

Week 12: Know how to do performance estimation, performance analysis and do engineering considerations.

Week 13: Know how to apply Divisible Load Theory and Fault Tolerance in RTS

Week 14: Know to demonstrate the knowledge gained in this course as a term project with a report and also as a power point with audio and share it on the Moodle with all the students and answer the questions and doubts on the "Moodle Forum".

Additional Comments

Since the instructor is now more focused on weekly outcome, the course is taught more creatively with effective guidance. The students interact with the instructor more and meet the outcome expectations. Delivering an online course is more challenging and combined with outcome driven concepts, the effort for teaching is much more, but greatly rewarding and effective.

References

- Biro, S., O'Tanyi, T. J. & Ziegenfuss, D. H. (2004). Preparing faculty to teach online: A successful collaboration. *Perspectives: The New York Journal of Adult Learning*, 3(1), 40-44.
<http://www.bestoutcome.com/assets/files/PDFs/Outcome-driven%20planning%20course%20profile.pdf>
http://en.wikipedia.org/wiki/Outcome-based_education
<http://www.ncrel.org/sdrs/areas/issues/envrnmnt/go/go4outcm.htm>
Diane M. Kimoto, Lorne Mulder, and Cory Jackson, and Jenny Frasco, "Outcome-Driven Learning: Creating Opportunities for Change", *Journal of Public Affairs Education*, 296-315,
www.naspaa.org/jpaemessenger/Article/VOL18-2/05_Kimoto.pdf