General Planning for ICT in Teacher Education: Template for 1-Credit Course

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The College of Education at the University of Oregon makes use of a large number of one-credit courses as part of its program of Information and Communication Technology (ICT) in Education. The great majority of these courses are taught by adjunct faculty. Such faculty receive a temporary contract for specified teaching duties, such as for the teaching of a specific course or several courses during a year.

The intent in having a wide variety of one-credit courses is to better meet the diverse needs and interests of preservice and inservice teachers. One of the "downsides" of this situation is that quality control and consistency within and across these courses is a challenge.

This document was created to facilitate discussion about this issues of quality and consistency, and to help the instructors of the various one-credit courses. It has two main parts.

1. Some general goals for ICT in Education.
2. A Planning Template, with two illustrations of its use. These illustrations are based on one-credit courses that I teach.

The UO is on a quarter system, with three quarters in an academic year. A quarter-length course has 10 weeks of class meetings; final exams are scheduled during the 11th week of the term. One quarter-hour of credit is 2/3 of a semester hour of credit.

The UO has published general guidelines that a 1-credit undergraduate course has 10 hours of class meetings and that students are expected to do approximately 20 hours of work outside of class. Thus, a one-credit undergraduate course corresponds to about 30 hours of student time and effort.

The guidelines also suggest that graduate courses require 20% to 25% additional time. That is, one quarter hour of graduate credit corresponds to approximately 36 to 37.5 hours of student time and effort. However, there is a huge variation in this among different parts of the University. A rough rule of thumb that many faculty in the College of Education at the University of Oregon follow is that a graduate course requires three hours of work outside of class for each hour in class, or a total of about 40 hours of time and effort for a one-credit course. The two examples given in this document are for graduate courses and are based on the 40-hour guideline.

Finally, please not that this document represents my personal opinions and does not necessarily reflect the opinion of other faculty in the Teacher Education unit of the UO College of Education.

General ICT in Education Principles:
Ideas that the Entire Faculty Should Understand

From a PreK-12 teacher point of view and from a teacher education faculty point of view there are three major general aspects or Goal Areas (GA1-GA3) of ICT in education:

GA1. ICT knowledge and skills that PreK-12 students are able to learn and "should" be learning as they progress through the grades and the specific courses they select when they have choices. ISTE has developed National Educational Technology Standards (NETS) for Students, and these provide a good starting point from what one might expect students to learn.

GA2. ICT as an aid to teaching PreK-12 students and as an aid to PreK-12 student learning. The ISTE NETS for Teachers provide us with some guidance in this area. However, this is a large, complex, and rapidly changing field.

GA3. ICT as an aid to increasing the personal productivity of a teacher. This might include such areas as learning to make use of an electronic gradebook, using a word processor when developing lesson plans, using the Web to do research on content areas to be taught, using email to communicate to parents and professional colleagues, and using ICT as an aid to one's own personal lifelong learning and capacity building.

I believe that we (the teacher education faculty) can agree on the need to set goals for our students in each of GA1-GA3. However, we have not developed and implemented such a set of goals.

Our students can make progress in all of these Goal Areas through a combination of Vehicles (V1-V4):

V1. Their own informal and formal education before they enter a teacher education program. Informal and formal educational experiences outside the College of Education while they are in a teacher education program. Miscellaneous other informal and other ICT and ICT-in-education learning opportunities that are available to our students during the time of life when they are in our teacher education programs.

V2. ICT that is integrated into Methods courses.

V3. ICT coursework provided in their teacher education program. This may include some of the 1-credit courses that motivated the development of this document.)

V4. ICT that is integrated into non-Methods and non-ICT coursework, including "content" courses, practicum courses, student teaching, Capstone Projects, and Work Samples.

We (all of the teacher education faculty) have individual and joint responsibility for defining and understanding goals for ICT in education to be met by our students, and helping our students to meet these goals. Here are a few general comments about the five vehicles listed above:

C1. We could (should?) establish ICT prerequisite knowledge and skills for admission into a teacher education program. A somewhat different approach would be to have clearly defined ICT prerequisite knowledge and skills, but to offer coursework that does not count towards the degree

requirements, and other opportunities for students, so they can quickly meet these requirements once they are admitted to one of our programs. Finally, we have some possibility of input to courses such as the mathematics for Elementary Teachers sequence. Thus, we should examine each of these types of courses and work to have them be supportive of our ICT in education goals.

C2.   ICT is now part of each discipline that is taught in schools. ICT is also and aid to teaching and an aid to learning in each discipline. To the extent that these observations are discipline specific, it is important that the Methods courses address these topics. To the extent that these ideas are broad based, essentially discipline-independent, they might be addressed in one or more 1-credit ICT courses.

C3.   We need to ask ourselves what can and should be better accomplished in these courses than in any of the other approaches to helping our students meet our ICT in education goals. Generally speaking, each of these courses will be taught by a person who is highly qualified in the overall field of ICT in education—probably more qualified than most or perhaps all of the faculty who do not teach ICT in education courses. The faculty will have breadth and depth of ICT in education knowledge and skills. Each course will address a clearly specified combination of GA1-GA3. The courses will be suitable for a wide range of students at both the preservice and inservice levels, both elementary and Mid/Sec levels, and perhaps also including Special Education students.

C4.   We are all familiar with the idea of reading and writing across the content areas. The same ideas are applicable to ICT. Our success in meeting goals for ICT in education is highly dependent on:

A.   Having all faculty members role-model appropriate uses of ICT in education.

B.   Expecting all students to make routine and appropriate use of ICT in their coursework.

C.   All faculty members providing appropriate feedback to their students on the appropriateness and quality of their ICT use.

In brief summary, as a faculty we need set student goals for ICT in education, and we need to agree on what we will do to help students achieve these goals.

General Planning Template
for 1-Credit ICT in Education Course

1.   Course title, 25-word catalog copy description.

2.   Prerequisite, stated in a form understandable to students and faculty.

3.   Expanded course description, approximately 150 words.

4.   List and briefly discuss the Big Ideas from the field of ICT in Education that underlie, unify, and justify this course. In your discussion, make it clear how the Big Ideas relate to: A) Increasing the personal productivity of the preservice or inservice teacher; and/or B) Improving the quality of education to be received by students of the preservice or inservice teacher.

5.   If this course includes a strong focus on one or more specific categories of software and/or hardware, list/describe the categories and briefly describe how they are central to the Big Ideas listed in (3).

6.   If this course includes specific instruction on one or more pieces of software or hardware, name the specific pieces, indicate how they fit into the specific categories named in (4), and discuss the choices from the point of view of suitability and availability to preservice and inservice teachers, and to their students. Discuss whether this course needs to be taught in a computer lab or in a Computers-on-Wheels (COW) environment.

7.   What percentages of the in-class instructional time and of the student learning efforts will be spent on each of the specific pieces of software named in (5)?

8.   Name the other major content areas of the course. Estimate the percentages of in-class instructional time to be spent on each.

9.   Briefly discuss how the course helps prepare preservice and inservice teachers to meet the ISTE National Educational Technology standards for Teachers and/or other relevant state and national ICT in education standards.

10. Provide a brief list of resource materials from which the general course content and the required readings will be drawn.

11. Sample syllabus. Provide a sample of a syllabus for the course.

Sample 1:
Roles of ICT in Problem Solving

1. **TED 610 (1 credit).** Introduction to problem solving and roles of computers in problem solving. Includes introduction to brain/mind science oriented toward helping you better understand human problem solving.

2. **Prerequisite.** The course assumes that students are facile with use of a Word Processor, Email, a Browser, and a Search Engine. It assumes a level of "teacher education maturity," which means familiarity with what is going on in school classrooms, what teachers do, what students are capable of doing, and so on. This might come from informal or formal in-school field experiences, observations, assisting teachers, and so on.

3. **Expanded Course Description.** Each academic discipline can be defined by the types of problems and tasks it addresses, the methodologies that it uses, its history and culture, and its accumulated results. ICT is an important aid to representing and addressing the problems and tasks of each academic discipline. This course explores general ideas of problem solving and ICT in problem solving and addresses the questions:

   • What types of problems can people solve better than ICT systems, and vice versa, and in what types of problems can the two working together far out perform either working alone?

   • For situations in which an ICT system can solve or substantially help in solving a type of problem that we currently teach students to solve using paper and pencil or other non-ICT techniques, what changes might we want to make in curriculum, instruction, and assessment?

   • How can we better teach students to be come more effective problem solvers?

4. **ICT in Education Big Ideas.** Perhaps the single most important idea in problem solving is that of building upon the accumulated knowledge and skills of others and oneself. Within each academic discipline, some of the accumulated knowledge and skill needed to represent the problems and tasks of the discipline, and to solve these problems and accomplish these tasks, can be substantially assisted (indeed, sometimes completely automated) through use of ICT systems. This makes it possible to increase the productivity of the learner (less details and procedures to learn) and the practitioner in the discipline. These types of capabilities of ICT are being steadily increased by:

   A. Research in each non-ICT discipline.

   B. Research in Computer and Information Science and Cognitive Science.

   C. The development of better software and more powerful hardware.

5. **General Categories of Software and Hardware.** The Big Ideas of this course are independent of any general categories of software or hardware. However, specific examples in the course will discuss some general categories such as:

   A. Calculators (4-function, algebraic, graphing) as examples of special purpose ICT systems that can solve or help solve a very wide range of problems, and are both inexpensive and easily portable.

B. ICT-enhanced scientific instrumentation, including probe ware that is now often used at the middle school and above in science courses.

C. Artificial Intelligence systems, including robots and Highly Interactive Intelligent Computer-Assisted Learning systems.

D. The Internet, including the Web. Together, they facilitate collaboration among problem-solvers and they provide access to a significant (and steadily growing) fraction of the accumulated knowledge of the human race.

6. **Instruction on Specific Pieces of Software or Hardware.** This course does not provide instruction on any specific software or hardware. It is not intended to be taught in a computer lab or COW environment.

7. **Time on Specific Software or Hardware.** No in-class time will be devoted to teaching specific software or hardware. No assignments require students to spend time learning specific software or hardware. [However, there is some exception to this. It is expected that assignments will be nicely and appropriately desktop published and turned in via email attachments. Students who do not know how to accomplish these two tasks are expected to learn them on their own or through other means. While the two topics will be mentioned in class, details will not be taught in class.]

8. **Content Areas.** Approximately equal amounts of class meeting time will be spent on each of the following content areas. (The remaining class meeting time gets spent on the mechanics of the overall course.)

1.	Introduction to topics in Brain Science (neuroscience) and Mind Science (psychology) that help to provide a foundation for teaching and learning about roles of computers in problem solving. Introduction to intelligence and artificial intelligence (machine intelligence).
2.	Definition of a formal, clearly defined problem. (The definition needs to be broad enough so that it can include problem posing and problem solving, question posing and question answering, task setting and accomplishing tasks, decision posing and decision making, etc.) Discussion of the idea that problem solving is an important component of each academic discipline. Importance of "ownership" and intrinsic motivation. Posing clearly defined and cognitively challenging problems, questions, and tasks.
3.	Problem and Task Team: Roles of people, aids to the human brain, and aids to people's physical capabilities in solving problems and accomplishing tasks. What types of problems can people solve better than ICT systems, and vice versa, and what types of problems can the two working together far out perform either working alone? For situations in which an ICT system can solve or substantially help in solving a type of problem that we currently teach students to solve using paper and pencil techniques, what changes might we want to make in curriculum, instruction, and assessment?
4.	Transfer of learning. Near and far transfer. Low-road and high-road transfer. Teaching for transfer. Roles of ICT in transfer. The general idea of strategies in high-road transfer. Some problem-solving strategies. Here we will emphasize strategies that tend to transfer across a number of disciplines, and strategies in which ICT makes a significant contribution.
5.	Meaning of Expertise within a specific discipline. Domain specificity versus domain independent knowledge and skill contributing to increased problem-solving expertise. Roles of ICT in having expertise within a discipline.
6.	Representations of a problem. There are advantages and disadvantages to various ways of representing a problem. Representing problems using computers. ICT aids to the "revise, revise, revise" or "hill climbing" approach to incremental improvements to a solution to a problem.

9. **Standards.** The ISTE Website http://cnets.iste.org/students/s_profiles.html contains profiles for students at various grade ranges, presented in a

manner to help define the ISTE standards expected at these grade levels. The general ideas of problem solving and related ideas to be presented in the 1-credit course appear in each of the profiles.

The ISTE NETS for Teachers includes a strong focus on problem solving. See http://cnets.iste.org/teachers/index.shtml.

Problem solving is considered to be one of the major goals of education. This is nicely discussed in David Perkin's 1992 book *Smart schools: Better thinking and learning for every child.* In brief summary, he indicates that the enduring goals of education are:

A. Acquisition and retention of knowledge and skills.

B. Understanding of one's acquired knowledge and skills.

C. Active use of one's acquired knowledge and skills. (Transfer of learning. Ability to apply one's learning to new settings. **Ability to analyze and solve novel problems.**)

10. **Resource Materials.** Resources are available in and through the following three books, and their extensive (mainly Web-based) bibliographies.

Moursund, D.G. (2003). Brief introduction to educational implications of Artificial Intelligence. Accessed 4/18/04: http://darkwing.uoregon.edu/%7emoursund/AIBook/.

Moursund, D.G. (2004). Improving elementary school math education: Some soles of brain/mind science and computers. The draft version of the first five chapters can be accessed as a PDF file from Accessed 4/18/04: http://darkwing.uoregon.edu/%7emoursund/SPSB/Short-course.htm.

Moursund, D.G. (2004). Brief introduction to roles of computers in problem solving. Accessed 4/18/04: http://darkwing.uoregon.edu/%7emoursund/SPSB/.

11. Syllabus. A syllabus for the version of the course taught by David Moursund in Spring 2004 is available at http://darkwing.uoregon.edu/%7emoursund/SPSB/Short-course.htm.

Sample 2:
ICT-Assisted Project-Based Learning

1. **TED 610 (1 credit).** Student-centered approach to curriculum, instruction, and assessment that focuses on students making routine and powerful uses of ICT as they develop products, performances, and presentations.

2. **Prerequisite.** The course assumes that students are facile with use of a Word Processor, Email, a Browser, and a Search Engine. It assumes a modest level of familiarity (a "talking knowledge") with a wide range of computer hardware and software such as digital still and video cameras, creating and using presentation graphics and interactive multimedia, and science data-gathering instrumentation. The course assumes that students are familiar with modern school classrooms, students, teachers as well as general ideas of curriculum, instruction, assessment, and developing a lesson plan for a unit of study of significant length. That is, it assumes more "teacher education maturity" than does the 1-credit course Roles of ICT in Problem Solving.

3. **Expanded Course Description.** Project-based learning (PBL) is a teaching methodology in which the teacher is a "guide on the side" rather than a "sage on the stage." It is a student-centered approach to teaching and learning that seeks to empower students and build upon their intrinsic motivation. In PBL, students work individually or in groups over an extended period of time to develop a product, presentation, or performance. Students gain increased skill in being independent, self-sufficient, intrinsically motivated learners.

   This course is designed for preservice and inservice teachers at all levels and in all fields. It explores roles of ICT in both the theory and practice of project-based learning and includes a brief introduction to problem-based learning. It includes a detailed step-by-step approach to planning and implementing PBL lessons—the curriculum content, the instructional processes, and the assessment. There is considerable emphasis on the development and use of rubrics for assessment.

4. **ICT in Education Big Ideas. There are three unifying ideas in this course:**

   - PBL is an effective approach to create multidisciplinary student-centered learning environments in which students learn to learn and learn by doing. ICT-assisted PBL can be used to create learning environments in which include routine use of ICT. This fits in well with both Situated Learning and Constructivism.
   - ICT-assisted PBL provides an environment in which specific ICT topics can be learned and practices, and in which students can make progress on a wide range of the ISTE National Educational Technology Standards for Students.
   - ICT-assisted PBL helps students to learn to make use of ICT as an aid to being an independent, self-sufficient learner as well as learning to work cooperatively in a group and to help their peers to learn.

5. **General Categories of Software and Hardware.** As PreK-12 students do ICT-assisted PBL, they draw upon their full range of knowledge and skills in the use of ICT tools. Thus, the course reading material and in-class discussions cover a wide range of hardware and software.

6. **Instruction on Specific Pieces of Software or Hardware.** This course does not provide any specific instruction in the use of specific pieces of ICT hardware or software. It is not designed to be taught in a computer lab or a COW environment.

7. **Time on Specific Software or Hardware.** No in-class time will be devoted to teaching specific software or hardware. No assignments require students to spend time learning specific software or hardware. [However, there is some exception to this. It is expected that assignments will be nicely and appropriately desktop published and turned in via email attachments. Students who do not know how to accomplish these two tasks are expected to learn them on their own or through other means. While the two topics will be mentioned in class, details will not be taught in class.]

8. **Content Areas.** Approximately equal amounts of class meeting time will be spent on each of the following content areas. (The remaining class meeting time gets spent on the mechanics of the overall course.)

1.	Definition of and introduction to Project-based Learning and Problem-based Learning. Small group and whole class sharing of personal PBL experiences as a student and/or as a teacher, at the precollege and college levels. The general theory of Situated Learning, and the ideas of "guide on the side" and "sage on the stage."
2.	Research supporting PBL. This includes research on: 1) Constructivism and Situated Learning; 2) Motivation Theory (intrinsic motivation); 3) Inquiry & Discovery-Based Learning; 4) Cooperative Learning; 5) Peer instruction; 6) Individual & Collaborative Problem Solving; 7) Problem-Based Learning; 8)Rubrics--clearly defined (not hidden) expectations; 9) Multiple forms of assessment. Clearly defined rubrics facilitate self-assessment, peer assessment, assessment by the teacher, and assessment by outside experts; and 10) Direct research studies on PBL.
3.	Examples of ICT-assisted PBL and sources of ICT-assisted PBL lessons and ideas. The PBL literature.
4	Planning a PBL lesson. Includes careful analysis of ICT-related goals and non-ICT-related goals in an ICT-assisted PBL lesson, and amounts of time to be spent on each.
5.	Implementing an ICT-assisted PBL lesson. Timelines, formative evaluation, and summative evaluation (including a strong focus on use of rubrics) for a PBL lesson. Discussion of student involvement in creating rubrics in a PBL lesson.

9. **Standards.** Hmmm. This looks like an interesting challenge. Possible components of this section might include:

    *   An analysis of the student-centered approaches recommended by ISTE in its National Educational Technology Standards for Teachers. See http://cnets.iste.org/teachers/index.shtml.
    *   Recommendations by various organizations and researchers on use of Situated Learning and Constructivism. (I am not aware of any "standards" that have been developed in these two areas.)
    *   Recommendations by various organizations and researchers on cooperative learning. (I am not aware of any "standards" that have been developed in these two areas.)

10. **Resource Materials.** Resources are available in and through the following t book and Website, and their extensive (mainly Web-based) bibliographies.

Moursund, D.G. (1999). *Project-based Learning in an Information Technology Environment*. Eugene, OR: ISTE. Revised edition published November 2002 by ISTE.

Moursund, D.G. *Project-Based Learning Website.* Accessed 4/26/04: http://darkwing.uoregon.edu/%7emoursund/PBL/.

11. **Syllabus.** A syllabus for the versions of the course taught by David Moursund in Fall 2003 is available at http://darkwing.uoregon.edu/%7emoursund/PBL/Syllabus641.html.