STRATEGIC PLAN FOR THE COLORADO STATE UNIVERSITY INFORMATION SCIENCE AND TECHNOLOGY CENTER (ISTeC)

October 21, 2002

Contents

1. Executive Summary

The Information Science and Technology Center (ISTeC) at Colorado State University (CSU) is an existing organization whose accomplishments include improving information science and technology (IS&T) education. This report is a strategic plan for broadening the scope of ISTeC to become a university-wide organization for promoting, facilitating, and enhancing CSU's research, education, and outreach activities pertaining to the design and innovative application of computer, communication, and information systems. ISTeC will be a faculty-driven organization and will function as a "Virtual College" within CSU in that it will encompass IS&T activities among faculty throughout the various existing colleges of the university.

The goals of ISTeC are to

- make CSU a world-class institution in IS&T that attracts outstanding students and faculty,
- help IS&T researchers and educators from different departments across the university to work together for their mutual benefit and the benefit of our students,
- expand the external support for and the breadth and depth of research in IS&T,
- provide staff and infrastructure support to enhance the effectiveness of faculty in obtaining external funding for IS&T activities,
- develop education programs and standards to ensure the IS&T competence of our students,
- enhance the IS&T scholarly and intellectual environment at CSU,
- establish long-term relationships with Colorado IS&T-related industries,
- publicize at the state, national, and international levels the impact of CSU's IS&T activities.

This strategic plan presents an organizational structure for ISTeC and enumerates research and education activities that ISTeC will pursue to achieve the above goals. Budget needs are discussed and, recognizing the current difficult financial times, a staged implementation plan is provided along with a set of initial action items that can be performed immediately.

2. Introduction and Mission Statement

Introduction

Information science and technology (IS&T) have become ubiquitous in our daily lives. Our ability to communicate, retrieve and analyze information, transact business, learn at our time and pace, be connected to the world, and generate knowledge has expanded in profound ways due to the capabilities of these technologies. IS&T is vastly improving human productivity, creativity, and quality of life. IS&T is creating new high-technology industries, new academic disciplines, new career fields, and the need for new programs of education and research. New ways of thinking about and carrying out university activities are required to meet these challenges.

Being an enlightened and responsible citizen in this Age of Information requires knowledge of computing technology, global communication networks, and interactive information resources. The requisite level of knowledge goes beyond being comfortable with computing and communication tools. It requires the ability to use IS&T in innovative ways in problem solving, experimentation, artistic expression, and design. In this era of rapid technological evolution, our ideas are no longer constrained solely by what is physically possible, but by what is computationally realizable and communicable.

It has been argued that this new era will reorder the reputations of universities in the United States. Because societies are dependent on information and communication technologies as engines of economic and social growth, those institutions with the most rapid, creative, effective, and significant responses to the growth of IS&T will rise to the top. Thus, well-publicized excellence in IS&T education and research is an increasingly important factor in determining the relative national rankings of universities.

The Information Science and Technology Center (ISTeC) at Colorado State University (CSU) was formed in January 2000. ISTeC initially focused on educational activities, and its accomplishments include the establishment of an IS&T Independent Studies Program. In the Fall of 2000, the CSU "Virtual College of Information Science and Technology" was proposed to expand the activities of ISTeC. It was referred to as a "Virtual College" because of the need to cut across boundaries and involve all the colleges of the university. As stated in their originating documentation, the combined mission of ISTeC and the Virtual College organizations is to increase the excellence and visibility of IS&T activities and programs at CSU. These organizations will nurture existing programs, and develop and nurture new ones, that will (a) conduct IS&T research, (b) build curricular and other bridges between the IS&T disciplines, (c) facilitate technology transfer between CSU and industry, (d) provide for career-long training for industrial IS&T professionals, and (e) ensure that all CSU graduates have an understanding of IS&T and its potential impacts on society.

In December of 2001, Tony Frank, CSU Vice President for Research and Information Technology, charged a strategic planning committee to determine what the scope, function, and goals of ISTeC and the Virtual College should be in order to accomplish their stated mission. After careful deliberation, the committee decided that ISTeC and the Virtual College should be a single organization, and operate under the name ISTeC. This report is a strategic plan for ISTeC to fulfill its and the Virtual College's mission.

Mission Statement

The Information Science and Technology Center (ISTeC) will be a university-wide organization for promoting, facilitating, and enhancing CSU's research, education, and outreach activities pertaining to the design and innovative application of computer, communication, and information systems. ISTeC will encompass IS&T activities among faculty throughout the various existing colleges of the university. Thus, ISTeC will cut across college boundaries to improve IS&T at CSU, with no barriers to participation. All of the faculty affiliated with ISTeC will maintain their appointments in existing colleges and departments, and will use ISTeC to unite to benefit IS&T research, education, and outreach. The planned growth of ISTeC sends a strong signal that CSU recognizes the need for special attention to this rapidly moving field and its impact on every academic unit and major in the university.

ISTeC will be a faculty-driven organization. The services provided by ISTeC, discussed later in this report, will be available to all CSU IS&T faculty and administrators; however, no one will be obliged to use them. For IS&T policy matters, ISTeC committees will act in an advisory role in conjunction with existing entities; however, it will not dictate CSU IS&T policy to colleges and departments.

The active advice and participation of leading IS&T companies in the state of Colorado is fundamental to the success of ISTeC's efforts to improve education and research in IS&T at CSU. Therefore ISTeC, as part of its outreach function, will interact with private enterprise to ensure its programs are responsive to commercial interests.

The rationale for ISTeC's existence is to significantly expand educational, research, and outreach activities and infrastructure in computing, communication, and information systems at CSU. ISTeC will help enhance existing programs and will be an incubator for new activities. The goals of ISTeC are to

- make CSU a world-class institution in IS&T that attracts outstanding students and faculty,
- help IS&T researchers and educators from different departments across the university to work together for their mutual benefit and the benefit of our students,
- expand the external support for and breadth and depth of research in IS&T,
- provide staff and infrastructure support to enhance the effectiveness of faculty in obtaining external funding for IS&T activities,
- develop education programs and standards to ensure the IS&T competence of our students,
- enhance the IS&T scholarly and intellectual environment at CSU,
- establish long-term relationships with Colorado IS&T-related industries,
- publicize at the state, national, and international levels the impact of CSU's IS&T activities.

ISTeC will benefit both undergraduate and graduate students in many ways. It will

- expand and orchestrate the course offerings in IS&T,
- promote and improve the use of IS&T tools in courses,

- ensure, through various assessment studies, that students learn the IS&T background necessary to succeed in today's world,
- help faculty increase the quality and quantity of IS&T research opportunities available to students,
- build relationships with Colorado IS&T companies that can lead to internships for our students.

ISTeC will be an essential component of the university, providing services for the faculty, students, and administration. It also will strengthen CSU's ties to Colorado IS&T industries.

Strategic Plan

The Strategic Planning Committee for ISTeC prepared this report. In developing this strategic plan, the committee

- solicited input from all CSU faculty by e-mail and in an open forum,
- discussed ISTeC informally with our faculty colleagues,
- incorporated guidance received from ISTeC's Industrial Advisory Council,
- merged in the ideas from the original ISTeC and Virtual College documentation, and
- spent more than a semester at weekly meetings (with "homework") brainstorming about what ISTeC could do for CSU.

The rest of this report is organized as follows. Section 3 provides a brief overview of the types of current IS&T activities at CSU. The organizational structure of ISTeC is given in Section 4. Sections 5 and 6 discuss the initial activities to be pursued by the Research Advisory Committee and Education Advisory Committee, respectively. A qualitative list of budget considerations is presented in Section 7, and initial action items in Section 8.

The Strategic Planning Committee for ISTeC

- Prof. H. J. Siegel (Chair), Electrical and Computer Engineering Dept. (College of Engineering) and Computer Science Dept. (College of Natural Sciences)
- Prof. Michael De Miranda, Manufacturing Technology and Construction Management Dept. (College of Applied Human Sciences)
- Prof. Donald J. Estep, Mathematics Dept. (College of Natural Sciences)
- Prof. Dale Grit, Computer Science Dept. (College of Natural Sciences)
- Prof. John Plotnicki, Computer Information Systems Dept. (College of Business)
- Prof. Louis Scharf, Electrical and Computer Engineering Dept. (College of Engineering) and Statistics Dept. (College of Natural Sciences)
- Prof. Peter B. Seel, Journalism and Technical Communication Dept. (College of Liberal Arts)

3. Overview of IS&T at CSU

The Strategic Planning Committee for ISTeC conducted an e-mail survey of the CSU faculty to determine how IS&T was viewed, and to solicit input on current IS&T-related activities on campus. The activities reported by the survey respondents covered a wide spectrum, from cutting-edge research into computer design and communication protocols to users of e-mail. At the risk of over-simplification, the responses can be divided into the four general categories below.

1. Activities that examine, implement, and improve the basic structures of IS&T. Examples include work on devices, networks, computer architecture, and software systems done primarily in the Department of Computer Science and Department of Electrical and Computer Engineering.
2. Activities that advance the capabilities of IS&T by improving and integrating IS&T functionality. Examples include precision agriculture, bioinformatics, computational chemistry, computational statistics, applied mathematics, telecommunications, and signal and image processing. This category includes the work of faculty from a wide variety of departments and programs.
3. Activities that use IS&T tools in innovative ways, but do not modify or enhance the basic tools. Category 3 includes activities such as certain business applications of IS&T, studies into Web page design, and most of the computer simulation and modeling activities on campus.
4. Activities that require IS&T tools, but do not fall into the preceding categories. The activities of those people who find a computer an indispensable part of their daily routine fall into category 4. Such activities include e-mail, Web access, course preparation and management (e.g., WebCT), word processing, and spreadsheets.

The lines between these categories often can be fuzzy. Individual faculty members may find that their activities within a single day fall into more than one category.

The university needs to consider all of these activities. To increase the productivity of the faculty, the university must provide the hardware and software support and system personnel for the category 4 activities. The faculty must have access to computer systems that are modern enough to support the software required for their activities, and must have access to the Internet. This is a baseline level of support required for all four categories. ISTeC may work with existing campus organizations to recommend standards in hardware and software, negotiate CSU site licenses for popular software packages, and explore the best ways to teach the use of standard software tools to faculty, staff, and students.

Categories 1, 2, and 3 form the core of IS&T research and education, and will be the focus of ISTeC activities. Historically, the resources for these activities usually have been provided through external funding sources or startup funds. ISTeC will be able to help coordinate the sharing of expensive or specialized resources among different research projects.

IS&T activities at CSU cover a large range of topics. ISTeC will build on this expertise.

4. Organization of ISTeC

Two faculty committees will conduct most ISTeC business: the *Education Advisory Committee* and the *Research Advisory Committee* (please see Figure 1). Their responsibilities are

- collect and collate faculty opinion and input,
- organize and coordinate ISTeC activities such as workshops, the Visiting Scholars Program, the Interdisciplinary Sabbatical Program, and the Distinguished Lecture Series,
- help to prepare recommendations to the administration and faculty committees on IS&T issues,
- determine subject areas and themes that ISTeC should emphasize each year,
- establish contacts with IS&T industry leaders and other educational institutions to learn from their experiences,
- conduct IS&T outreach, making use of existing continuing education and industrial liaison groups at CSU as appropriate,
- prioritize the lists of committee activities given in Sections 5 and 6 of this report,
- develop metrics that can used to measure the success of each committee's work.

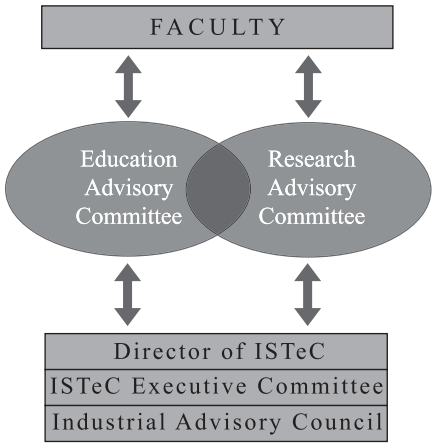

Figure 1: The Overall Structure of ISTeC.

The Advisory Committees will be chaired by faculty members and composed *primarily* of faculty members. Each college in the university may appoint one faculty representative to each committee. In addition, faculty and administration personnel appointed by the ISTeC Executive Committee will augment the membership of each committee; suggestions for such additions can come from the college deans, from faculty volunteers, from the ISTeC Executive Committee members, or other sources. Once the Advisory Committees are informed, each will decide if it should include student representatives in the committee or any of its subcommittees that may be formed. The Advisory Committees should also determine if there are members of the ISTeC Industrial Advisory Council (IAC) who should be invited to join that committee or one of its

subcommittees. The number of members of each committee will be between ten and fifteen. Advisory Committee meetings will be open, and faculty and IAC members are welcome to come to provide ideas and comments. The agenda for each Advisory Committee meeting will be circulated to faculty who request to be informed and to the IAC members so they can provide inputs before the meeting or attend the meeting. The minutes will be made available after each meeting. The committees will be assisted in their activities by the ISTeC staff, and will leverage the strengths of existing CSU groups.

The Advisory Committees will be monitored and coordinated by the *ISTeC Executive Committee*. The ISTeC Executive Committee will be chaired by the *ISTeC Director* (a faculty member) and will be composed of the two Chairs of the Advisory Committees, the Director of ACNS (Academic Computing & Network Services), and a representative from the Office of the Vice-President for Research and Information Technology. Responsibilities of the ISTeC Executive Committee are to

- coordinate the activities of the Advisory Committees,
- work with ACNS on infrastructure issues,
- communicate ISTeC documents to the CSU administration, college deans, faculty committees, and organizations outside of ISTeC,
- appoint additional members to the Advisory Committees,
- apportion ISTeC resources between the Advisory Committees, e.g., support staff, limited funds, and space,
- attend the semi-annual ISTeC IAC meetings,
- examine ways to get more input from the IAC, such as sending them Executive Committee meeting agendas in advance so that IAC members can send suggestions or attend.

The administrative head of ISTeC will be a faculty member with a half-time appointment as the *ISTeC Director*. Responsibilities of the ISTeC Director are to

- supervise the day-to-day operations of ISTeC,
- chair the ISTeC Executive Committee and the Industrial Advisory Council,
- serve as the primary ISTeC executive-level contact both inside and outside of CSU, including with the CSU administration, CSU faculty committees, chairs or heads of CSU departments, industry, government agencies, political organizations and people, and funding agencies,
- identify and promote interdisciplinary opportunities.

The ISTeC Director will report to the Office of the Vice-President for Research and Information Technology.

The *Industrial Advisory Council (IAC)* will consist of representatives from Colorado industries interested in IS&T. There is an existing ISTeC IAC, and the ISTeC Director will work to expand its size and scope. The IAC was formed so that ISTeC can build and maintain strong interactions with Colorado IS&T industries. The IAC members will be in a position to influence the development and direction of IS&T at CSU. Their familiarity with CSU will allow them to better

access students who are potential interns and future employees, as well as access the expertise of ISTeC faculty. The assistance ISTeC hopes to receive from their IAC includes

- input to curriculum development to help assure its relevancy,
- scholarships and internships for students,
- guidance in developing and offering programs at a distance,
- identification and encouragement of employees who can serve as adjunct faculty, guest lecturers, or advanced degree students,
- definition of significant research thrusts and identification of resources to support them,
- identification of resource needs and how to obtain them from external sources,
- assistance in bringing together industry people and faculty in joint research ventures (including government proposals),
- use of consulting and other forms of interaction to help in faculty recruiting and retention,
- participation in the securing of funds for endowed professorships,
- determination of what the relationship between the ISTeC IAC and departmental Industrial Advisory Boards (IABs) should be.

Given this organization, most of the work of ISTeC will be conducted in the Advisory Committees. More information about the potential activities of the Research and Education Advisory Committees is given in the following sections of this report. ISTeC outreach work will be part of the activities of these Advisory Committees, and will be conducted in conjunction with existing continuing education and industrial liaison groups at CSU.

5. Research Advisory Committee

The goals of the Research Advisory Committee are to enhance the quality of IS&T research at CSU, encourage interaction among relevant IS&T faculty members, incubate new IS&T research programs, assist in the preparation of IS&T proposals for external funding, stimulate interaction between CSU and Colorado IS&T industries, and publicize CSU's IS&T research activities. Based on current trends, it is expected that individual researchers, working in isolation, will become less able to compete for funding for complex research problems. Most major IS&T research activities of the future will be multidisciplinary and multi-investigator in nature. In general, it will not be possible to continually rely on the informal and "ad hoc" leadership of one or two faculty to coordinate and organize such large-scale proposal efforts. A more formal, recognized structure, such as the ISTeC Research Advisory Committee, is needed to track major funding opportunities, be aware of the faculty expertise and existing research programs on campus, and help coordinate the relevant people and groups to respond to funding opportunities.

The initial activities of the Research Advisory Committee will include the following. We expect this list to change over time based on ideas from the committee members, other faculty, administrators, and members of our Industrial Advisory Council.

1. Promote cooperation and interaction among various groups of researchers in IS&T throughout campus and incubate new research in IS&T.
    a. Maintain a database of faculty and their IS&T research expertise. This database will be used to find faculty with relevant interests for a given research effort proposed by ISTeC or a faculty member. It will also provide an expertise list for industry, national laboratories, and the press.
    b. Organize *Overview* meetings where any department may present a high-level overview of ISTeC-related research (and educational and outreach) activities in that department. The goal is to publicize ISTeC-related activities occurring across campus. This can lead to more specialized and detailed meetings (see below).
    c. Organize a series of workshops, meetings, and seminars to increase the general level of knowledge about IS&T research and to discuss "hot" areas of research that could use an interdisciplinary approach. Examples of such areas include bioinformatics, homeland security, mobile communication, and pervasive computing. These interdisciplinary faculty-brainstorming sessions will facilitate interaction among faculty by providing a vehicle for exploring areas of potential common interest. It is important to establish groups that have shared research interests as soon as possible so that when appropriate funding opportunities arise they can be recognized as relevant and the CSU proposal response will be more proactive than reactive. Thus, these meetings will serve as a catalyst to attract investigators to large proposals. Seminars and workshops can be proposed and orchestrated by the ISTeC Research Advisory Committee or any CSU faculty.
    d. When requested by proposal authors, help organize a "red team" of qualified faculty willing to give a constructive critical review of a proposal before it is submitted to give the authors feedback they can use in polishing the proposal.
    e. Provide full or partial support for a *Scholars in Residence Program*. This program will bring in visiting scholars from industry or other universities who are leaders in research

and/or education in IS&T. The principal duties of a visiting scholar will be to interact with groups in IS&T at CSU and to organize an advanced seminar series where the scholar teaches and guides discussion in areas related to his or her expertise and interests. A Scholar in Residence will visit CSU for one or two semesters and ideally impact several departments/groups.

f. Support an *Interdisciplinary Sabbatical Program* for CSU faculty and graduate students. The aim of this program is to seed interdisciplinary research in IS&T at CSU by immersing CSU faculty and students in new disciplines. For CSU faculty, the program will provide support to cover the faculty member's home department teaching responsibilities so that the faculty member can relocate into another department for one or two semesters. The principal duties of the visiting faculty member will be to interact on research activities with one or more research groups in that other department, including taking and giving advanced courses, participating in seminars and group meetings, writing research proposals, co-advising Ph.D. theses, and co-authoring research papers. The program will also provide graduate research assistantships for CSU Ph.D. students whose theses involve a significant interdisciplinary component.

g. Sponsor several *ISTeC Distinguished Lectures* on the CSU campus each semester, with external speakers who have national reputations. This will stimulate research activities, inform influential speakers about CSU research, and provide an opportunity for CSU IS&T faculty to interact. These lectures will be advertised to universities and IS&T industries throughout the state (using mailing lists built and maintained by the ISTeC staff), increasing our interaction with these groups. Furthermore, Colorado companies with a particular interest in a given speaker's area will be invited to co-sponsor the lecture. Special workshops focusing on the speaker's topic can be organized in conjunction with the lecture, with participants invited from campus and industry.

h. Facilitate and develop protocols for the voluntary sharing of computational and communication capacity for IS&T activities on campus.

i. Examine ways to provide CSU's input to various governmental groups on public policy issues that impact IS&T research.

2. Provide experienced ISTeC staff to facilitate large-scale and interdisciplinary proposal development in IS&T.

   a. Provide an organized mechanism for identifying pertinent funding opportunities (in addition to SMARTS). These opportunities will include government funding agencies and industrial consortia.

   b. Provide a search mechanism for finding suitable faculty groups for multidisciplinary proposals.

   c. Provide staff assistance for submission of proposals, e.g., including preparing budgets, generating boilerplate, and seamless incorporation of multi-authored material (including text, figures, tables, vita, and references). Such assistance will help maximize the effectiveness of faculty time spent on proposal preparation.

   d. Provide a way to coordinate proposals aimed at multi-university opportunities.

3. Publicize CSU IS&T research activities to other universities, funding agencies, and industry.

   a. Provide a carefully designed, frequently updated website describing campus activities in IS&T. Any CSU faculty can include a summary of their research in the ISTeC website,

with a pointer to their home page for more details. This collection of research summaries will be organized in a uniform format that is easy to navigate. The website could provide detailed descriptions of selected success stories and special efforts. Furthermore, the ISTeC staff could provide assistance in the design and maintenance of the home pages of research projects that were submitted through ISTeC.

b. Advertise relevant IS&T seminars that are offered on campus.

c. Build a directory of CSU faculty who wish to give talks, tutorials, or short courses at industry sites on IS&T topics. Short courses could involve multiple faculty members. This information will be included in the ISTeC website, and thus publicly available.

d. Work with existing CSU publicity organizations on press releases.

e. Provide materials (or pointers to materials) such as course notes (volunteered by faculty) and digital recordings of special seminars to the public through the website.

4. Facilitate research activities for CSU faculty involving regional IS&T industry and national laboratories to develop long-term relationships. The specific projects we interact on can be short term or long term. Funding can be in terms of contracts, subcontracts, student internships, consulting, and/or joint government contracts.

   a. Organize one-day workshops about CSU activities in IS&T research. These technical workshops will be one way to provide a vehicle for an exchange of ideas with industry and national labs. Each workshop will be held at a company or lab site, will be very focused, and will have both CSU faculty and industry/lab representatives speak.

   b. Build a directory of IS&T faculty expertise and post it on the ISTeC website to help industry, government laboratories, and faculty identify particular activities at CSU. This will include the faculty speaker directory mentioned above.

   c. Request regional IS&T industries to hold a general “university day” at their industrial site, for faculty and students to learn about that company.

   d. Build a directory of key people in Colorado industries to help CSU faculty identify relevant industry contacts for collaborative or supportive research.

   e. Build a directory of people in Colorado industries who are interested in giving departmental seminars and/or giving one or more guest lectures in relevant classes. These activities could include involvement in senior design courses (possibly even on a weekly basis).

   f. Provide a mechanism for posing research questions and issues to CSU faculty from external sources.

   g. Help establish CSU/industry interactions that can lead to centers of excellence in specific areas of IS&T. These centers will receive support from funding agencies and a set of industries with some common interests.

   h. Work with the appropriate CSU and industry people to establish guidelines for handling intellectual property in joint CSU-industry ventures.

   i. Find additional avenues to facilitate technology transfer between CSU and industry.

   j. Explore ways to obtain from Colorado companies surplus research equipment and access to unused time on their IS&T facilities (e.g., test beds).

k. Advertise to the campus IS&T speakers who will be giving public presentations at Colorado companies.

5. Advise the administration on issues related to research in IS&T. ISTeC can do this by collecting information and opinions from associated faculty, holding forums for faculty to argue specific issues and cases, and collating collected information into a coherent opinion.
   a. Give advice about investment of cost-sharing funds for IS&T-related proposals, and help negotiate with the administration on cost-sharing for proposals submitted through ISTeC.
   b. Give direction for university investments in major new initiatives in IS&T.
   c. Give advice about the hiring of faculty involved in relevant IS&T research areas.
   e. Give advice about significant university investments in IS&T equipment and other IS&T infrastructure needs, e.g., networking, software packages.
   f. Give advice on IS&T proposal selection when institutions are limited in the number of proposals they can submit.
6. Focus the energies of the Research Advisory Committee.
   a. Prioritize the above list of committee activities.
   b. Determine subject areas and themes that ISTeC should emphasize each year,
   c. Select a specific set of industrial interactions to work on with the IAC each year.
7. Develop metrics that can be used to measure how successful the Research Advisory Committee has been in its pursuit of its goals (as stated in the beginning of this section).
   a. Clearly define quantifiable metrics.
   b. Prepare a written report for the ISTeC Executive Committee each year using these metrics to evaluate the year's activities.
   c. Annually review the definition of the metrics, and, if determined appropriate, make suggestions for enhancing these metrics.

6. Education Advisory Committee

The ISTeC Education Advisory Committee will take a leadership role in coordinating the future direction of IS&T education at CSU. By bridging the gaps between colleges and departments, ISTeC can promote (a) the use of IS&T teaching tools, (b) the development of innovative IS&T curricula, and (c) related research efforts that will enhance the educational experiences of CSU students. The committee will work with other existing groups on campus as appropriate.

CSU graduates in all academic disciplines will utilize IS&T tools in their professional lives. ISTeC will provide advice to departments on new and revised curricula to address the universality of IS&T in all fields. ISTeC will be the portal for interested students to learn about CSU's IS&T programs and access them easily.

The data from the *Computer Skills Assessment Survey* (conducted in December 2001) reveal significant disparities in first-year student entry-level skills (see Appendix A). This "digital divide" in our first-year students will inhibit the learning opportunities at CSU for those with less-developed computer skills. Efforts must be made to close this divide in the student's first year of classes at CSU.

The activities of the Education Advisory Committee will be divided into three major areas -- *curriculum assessment, curricular innovation,* and *promotional outreach efforts*. The three are linked in that we expect that information gained from the assessment process will influence innovative solutions to identified opportunities and problems. Once we have these innovative programs in place, we need to promote and market them to appropriate groups of students.

One guiding principle for revisions and additions to the IS&T curriculum at CSU should be a new focus on *outcomes assessment* to ensure that our graduates have acquired the needed information technology knowledge and skills while attending the university. This approach is congruent with the Colorado Commission on Higher Education's (CCHE's) *Recommendations for Core Curriculum Education in Information Technology* outlined in Appendix B. This outcomes assessment approach can also be included in existing capstone courses that integrate knowledge acquired in undergraduate studies.

The initial activities of the Education Advisory Committee are outlined below. We expect this list to change over time based on ideas from ISTeC committee members, other faculty, administrators, and the Industrial Advisory Council. For some of the activities listed (such as teaching short courses on IS&T topics at local industry sites), the faculty involved will need appropriate compensation and assistance.

1. Conduct assessment activities related to the present IS&T curriculum and suggest revisions and enhancements.
    a. Investigate the adoption of the *Fluency in Information Technology (FIT)* model for technology education for all students. The FIT model is outlined in Appendix C of this report. We feel that this document is an ideal starting point for defining educational objectives related to IS&T. ISTeC will also investigate how to incorporate *The Standards for Technological Literacy (STL)* developed by the National Science Foundation, NASA, and The International Technology Education Association.

b. Explore university-wide IS&T curriculum modifications based on the 2002 core curriculum guidelines issued by the CCHE (see Appendix B). We feel that the university can comply with these CCHE guidelines without making a major revision to the All-University Core Curriculum by considering the adoption of the FIT model.

c. Encourage the IS&T degree programs or options within existing departments, using as templates the structures developed by the Department of Electrical and Computer Engineering and the Department of Mathematics.

d. Work with CCHE and the state's community colleges to assure that transfer students from those institutions arrive at CSU with the necessary computer skills or have training in those skills available to them. Also, this committee can help develop guidelines on how community college credit for IS&T courses should be counted at CSU.

e. Undertake a systematic annual research project modeled on the 2001 Computer Skills Assessment Survey to assess the IS&T knowledge base and skill set of first year students. The purpose of this assessment process is to identify deficiencies in the IS&T preparation of new CSU students and to define a variety of instructional modalities to bring these students to baseline knowledge and skill levels.

f. Work on a similar survey to be administered after 2006 to a random sample of seniors in university capstone courses to assess if we have achieved our institutional IS&T educational objectives. The committee will also consider a related survey to be conducted one year after the students graduate.

g. Participate in discussions and recommendations concerning student ownership of personal computers at CSU.

h. Study the computer competencies required of our graduate students and suggest options for enhancing them. ISTeC will work in a consultative role with departments and colleges seeking advice on improving graduate student knowledge of IS&T theories and skills related to both coursework and research practices.

i. Explore ways to offer to students short courses on the use of software tools. Present Computer Training and Support Services (CTSS) courses are limited to faculty and staff.

j. Consider the university-wide adoption of a computer skills certification process, patterned after the *International Computer Driving License (ICDL)* system. This program would be optional, but available to all university students entering professions requiring the routine use of fundamental computer applications (e.g., spreadsheet use, database creation, digital presentations, and Web authoring). This certification will provide CSU students with a competitive advantage in seeking employment.

2. Investigate, develop, and implement curricular innovations in IS&T education.

a. Establish and supervise an *ISTeC Curriculum Forum* that will facilitate inter-departmental discussions on IS&T curriculum issues and the integration of IS&T content into existing CSU courses (including the recommendation of baseline standards for all university courses in Web design and computer programming). This forum will also enable faculty and staff using IS&T tools in their courses to demonstrate their success (using before and after outcome assessments).

b. Hold an annual summer conference of one or two days for CSU educators involved in the IS&T curriculum to plan the activities of the *ISTeC Curriculum Forum*. Relevant educators from other institutions may also be invited.

c. Use both of these fora as a means of bringing together faculty interested in using IS&T to help educate students with disabilities.

d. Develop a plan to identify and recruit talented new faculty to teach in needed IS&T areas. Work with IS&T departments to investigate joint appointments where appropriate.

e. Invite faculty from other universities to come to campus for one or two semesters as part of an *Educator in Residence Program*. The visiting faculty member can circulate among interested departments as a consultant in the development or enhancement of IS&T courses and programs.

f. Sponsor workshops, seminars, and inter-university teleconferences to explore innovative methods of using IS&T tools and concepts in the teaching of courses in all academic disciplines.

g. Provide short courses and certificate programs designed to augment the education, background, and skills of IS&T professionals in industry. Investigate the use of distance education tools to deliver these courses and programs, as well as existing curricular offerings.

h. Collect and disseminate to the campus information on external funding opportunities for curricular innovation in IS&T.

i. Find ways to integrate IS&T fundamental concepts in first-year seminars or similar courses that facilitate their presentation to first-year students.

j. Determine the type of facilities needed (e.g., specific hardware and software for electronic classrooms) to support innovative IS&T instruction.

k. Examine methods of providing CSU's input on IS&T-related public policy issues to governmental groups. Invite faculty with interest and expertise in this area to use ISTeC as a forum to discuss these issues and publish white papers for distribution to government agencies.

l. Investigate the inclusion of ethical issues related to IS&T in courses at CSU. Create ISTeC-sponsored seminars on these issues with guest speakers from government, industry, and foundations.

m. Help develop innovative IS&T plans for the university to integrate the services of the electronic "Library of the Future" to utilize the best practices of information science to deliver academic information on demand to students on campus and at a distance, 24 hours a day, seven days a week. The committee will work with library staff to investigate the potential for the electronic submission of theses and dissertation by graduate students at CSU.

3. Promote existing and newly developed IS&T programs on campus and with external groups in K-12, community colleges, and industry.

   a. Create a campaign to recruit the best and brightest prospective IS&T students to attend CSU. Emphasize recruitment efforts with high school juniors and community college students.

   b. Advertise and promote ISTeC's new *Interdisciplinary Studies Program (ISP) in Information Science and Technology*. Work with the Industrial Advisory Council to promote the online version of the program for their employees, which will be available in Fall 2003. Seek online course development grants similar to the one awarded to ISTeC

this year by the industry-funded Colorado Institute of Technology. ISTeC may also investigate revising university academic policy so that this program can be listed as a true Minor rather than an ISP.

c. Conduct annual briefing sessions for undergraduate advisors, including the Help/Success Center, to make them aware of IS&T course and program offerings.

d. Integrate ISTeC's *Interdisciplinary Studies Program* into the current technology education and training (TET) degree programs. The new integrated program will prepare teachers who will enter Colorado's secondary schools and teach IS&T to their students.

e. Use the ISTeC website to publicize IS&T course offerings, including the on-campus and distance *Interdisciplinary Studies Program*. The site will also be used to publicize guest speakers and special educational events. The ISTeC website will be the portal for accessing information about IS&T at CSU by external audiences and should exemplify the highest standards for site design and usability. It will be one of the primary information and promotion instruments for recruiting prospective IS&T students to CSU.

4. Analogous to item 4j in Section 5, explore ways to enhance courses through Colorado companies' surplus equipment and access to unused time on their IS&T facilities.

5. Focus the energies of the Education Advisory Committee in the way that was described for the Research Advisory Committee in Section 5 (activity 6).

6. Develop metrics that can be used to measure how successful the Education Advisory Committee has been in its pursuit of its goals, in the way that was described for the Research Advisory Committee in Section 5 (activity 7). For the Education Advisory Committee, the goals being pursued are to assess the IS&T curriculum, devise innovative curricular enhancements, and promote outreach efforts.

7. Budget Considerations

This is a list of proposed ISTeC activities that will require a financial commitment. The financial needs are described qualitatively, rather than quantitatively.

1. *ISTeC Director.* Funding is needed to support space, office expenses, travel (such as industry site and funding agency visits), and half the salary of the ISTeC Director. An existing CSU faculty member may act as an interim ISTeC Director.
2. *ISTeC Staff.* ISTeC will need office staff and equipment to support the activities listed below. We estimate the staff needs as one administrative professional and two full-time clerical people capable of handling the activities listed below, assisted, when necessary, by existing system administrators (e.g., for website maintenance) and business office personnel (e.g., for final budget preparation). The staff will need space and office equipment such as personal computers, Internet connections, and a high-quality printer, and the usual expendable supplies. In addition, ISTeC will need access to visual presentation projectors, presentation recording equipment (such as videotape or DVD), and teleconferencing facilities. The ISTeC staff activities will include the following.
    a. Maintain the ISTeC website.
    b. Maintain the ISTeC database of IS&T faculty, including a public directory of CSU faculty who wish to give talks, tutorials, or short courses at industry sites on IS&T topics.
    c. Maintain the ISTeC database of relevant industry contacts, including a directory of industrial people who wish to give talks, tutorials, or short courses at CSU on IS&T topics.
    d. Provide organizational support for ISTeC sponsored workshops, meetings, seminars, and teleconferences.
    e. Prepare and distribute ISTeC publications, such as newsletters, press releases, and announcements.
    f. Provide support for proposal preparation, including preparing budgets, generating boilerplate, and seamless incorporation of multi-authored material (such as text, figures, tables, vita, and references).
    g. Provide materials such as course notes (volunteered by faculty) and digital recordings of special seminars to the public through the website, on videotape, or DVD.
    h. Filter, answer, and forward outside inquiries about ISTeC related activities and faculty.
    i. Conduct surveys and studies about ISTeC matters among such groups as faculty, students, alumni, Colorado industry, and other institutions.
3. *ISTeC Gatherings and Distinguished Lectures.* Organizational costs for ISTeC Distinguished Lectures, workshops, and meetings; e.g., refreshments, participants' packets, and travel costs for invited speakers.
4. *Scholars in Residence Program and Educators in Residence Program.* The cost is primarily faculty salary (typically partial), as well as travel and moving expenses.
5. *Interdisciplinary Sabbatical Program.* The cost is to cover the teaching load of a faculty who takes a sabbatical in another CSU department, and student salary for any students who might accompany the faculty.

6. *Faculty Travel.* Travel costs for CSU faculty traveling on official ISTeC business to industry sites and funding agencies.
7. *Space.* In the short term, ISTeC needs space for a teleconferencing facility, a lounge, meeting rooms, and offices for the ISTeC Director, and staff. In the long term, a successful ISTeC will need space to house IS&T research and education activities, including IS&T laboratories and computer classrooms. We envision that this space will be used by CSU faculty and students, interdisciplinary postdocs and visiting scholars, and industrial colleagues.

As stated earlier, the charge to this committee was to determine what should be the scope, function, and goals of ISTeC; we were not asked to determine how ISTeC would be funded. However, we have some thoughts about this that we wish to share.

The ISTeC described here is a program in academic enrichment. Therefore, the Strategic Planning Committee recommends that the ISTeC described in this report be established with a one-time, multi-year investment from AEP (Academic Enrichment Program) funds. From then on, the university should include ISTeC in its normal operating budget as an important university-wide service.

One of the goals of ISTeC is to increase the amount of externally funded IS&T research at CSU, which, in turn, will increase the amount of contract and grant overhead that will become part of CSU's central operating funds. Certain of ISTeC's educational activities (including outreach) will also bring in added revenue to CSU. Thus, the university's central administration will have a larger operating fund as a result of ISTeC's activities. It is critical that the support for ISTeC not affect departmental overhead return and not result in any department being taxed; we want ISTeC to be a service that helps the university grow and improve, and does not impose a burden on departments or faculty in any way. We feel the university should view ISTeC as a wise investment that the university can make to ensure that CSU will have a strong future in IS&T education, research, and outreach.

For this plan to have its intended impact, it should be funded in its entirety. However, if necessary, this ISTeC plan can be implemented in stages. If that is done, we recommend that items 1 through 3 comprise stage 1 (possibly with an existing faculty member functioning as an interim Director), items 4 and 5 comprise stage 2, and items 6 and 7 comprise stage 3.

8. Initial Action Items

To get started on implementing the strategic plans laid out in this report during these difficult economic times, the following action items may be taken.

1. Appoint an existing faculty member as the first Director of ISTeC. This Director will be most likely be limited in the time that can be committed to ISTeC and will focus on implementing the action items below.
2. Form the Research and Education Advisory Committees.
3. Charge each Advisory Committee to evaluate and prioritize its list of proposed activities given in this report.
4. Charge each Advisory Committee to execute as many of the high priority activities as possible.
5. Charge each Advisory Committee to examine what metrics will be appropriate to measure its progress toward its goals.
6. Form the Executive Committee.
7. Charge the Executive Committee to determine how to obtain the funding needed for the items listed in Section 7 of this report.
8. Charge the Executive Committee to explore how to best inform the faculty and IAC of ISTeC activities.

As soon as possible, the implementation of the entire ISTeC plan should take place.

9. Concluding Remarks

The ISTeC Strategic Planning Committee thanks the CSU administration for initiating ISTeC and for deciding to expand it. We appreciate having had the opportunity to serve on this planning committee.

We look forward to the success of ISTeC, and its positive impact on IS&T research and education activities at CSU, including related outreach functions. We feel that implementing the ISTeC described in this report will greatly enhance the IS&T scholarly and intellectual environment at CSU, increase the external financial support for IS&T activities, and improve CSU's reputation and ranking as a university.

The committee recommends that CSU establish the ISTeC described in this plan as part of its commitment to IS&T.

Appendix A:
Computer Skills Assessment Survey

Selected raw data from the 2001 Computer Skills Assessment Survey
CSU first-year students surveyed = **1,933 = 49% of 3,980 first-year students**

E-mail

11. I have an e-mail account. A) 2067 (98.33%) Yes B) 22 No (if no, skip to question # 15)

12. I can attach a file when I send e-mail A) 1708 (81.26%) Yes B) 368 No

13. I read e-mail: A) 305 (14.51%) weekly B) 1671 (79.50%) daily C) 103 other

14. My e-mail is:
    A) 995 (47.34%) CSU – holly/lamar
    B) 37 (1.76%) CSU - my college
    C) 865 (41.14%) Commercial
    D) 23 (1.09%) Don't know

15. I can get a free e-mail account from CSU: A) 2013 (95.77%) Yes B) 65 (3.09%) No

World Wide Web

16. I use the Web for games	A) 1009 (48.00%) Yes	B) 1081 (51.43%) No
17. I use the Web for newsgroups	A) 776 (36.92%) Yes	B) 1313 (62.46%) No
18. I use the Web for e-mail	A) 2006 (95.43%) Yes	B) 85 (4.04%) No
19. I use the Web for watching video	A) 888 (42.25%) Yes	B) 1202 (57.18%) No
20. I use the Web for music	A) 1847 (87.87%) Yes	B) 245 (11.66%) No
21. I use the Web for library – research	A) 2019 (96.05%) Yes	B) 71 (3.38%) No
22. I use the Web for finding info about CSU	A) 1915 (91.10%) Yes	B) 151 (7.18%) No

23. I have been using the Web for:
    A) 38 (1.81%) 3 Months
    B) 36 (1.71%) 6 Months
    C) 82 (3.90%) 1 year
    D) 98 (4.66%) 1.5 years
    E) 1838 (87.44%) 2 years or more

24. I <u>most often</u> use the Web from:
    A) 53 (2.52%) Midnight - 5:59 am
    B) 60 (2.85%) 6 am - noon
    C) 575 (27.35%) 12:01pm - 5:59pm
    D) 1368 (65.08%) 6:00pm - 11:59pm

25. I connect to the Web with:
    A) 1423 (67.70%) Campus Network
    B) 261 (12.42%) DSL/Cable Modem
    C) 212 (10.09%) Modem & Phone line
    D) 19 (0.90%) Other
    E) 163 (7.75%) Don’t know

Software

Please rate your experience with each of the following Software:

	A) Very Proficient	B) Somewhat Proficient	C)Marginally Proficient	D) Never Used
26. Word Processing (e.g. WordPerfect, Word)	1595	442	37	12
27. Spreadsheets (e.g. QuattroPro, Excel)	457	764	552	304
28. Presentation (e.g. MS PowerPoint, Corel)	582	636	433	425
29. Database (e.g. MS Access, Foxpro, Oracle)	238	367	488	947
30. Browser (e.g. Netscape, Internet Explorer)	1464	469	69	80
31. Web Animation (e.g. Fireworks, Flash)	188	304	412	1140
32. Html	421	523	531	582
33. Programming (e.g. C++, Java, Perl)	105	216	352	1342
34. Graphics (e.g. Adobe Photoshop, Illustrator)	347	505	543	658
35. Desktop Publishing (e.g. Adobe PageMaker)	270	351	410	1008
36. Web Development (e.g. Composer, Dreamweaver, FrontPage)	138	203	311	1360
37. Digital Video (e.g. Final Cut Pro, Avid)	168	223	326	1293
38. Digital Audio (e.g. Sound Forge, Sound Edit)	224	276	396	1125

39. I am familiar with downloading and installing software.	A) 1722 (81.92%) Yes	B) 347 (16.51%) No
40. I am familiar with downloading and installing plug-ins.	A) 960 (45.67%) Yes	B) 1106 (52.62%) No
41. I am familiar with downloading and reading pdf files.	A) 864 (41.10%) Yes	B) 1184 (56.33%) No
42. In high school I had training in online information gathering.	A) 1088 (51.76%) Yes	B) 982 (46.72%) No

43. If my teacher asks me to use scholarly articles to write a research paper on violence in American public schools, I would first look:

A). 1224 (58.23%) The Internet, using a search engine like Yahoo, Google, or Excite.
B). 479 (22.79%) A database or index of abstracts and citations.
C). 279 (13.27%) Browse/flip through scholarly journals in the library.
D). 99 (4.71%) I don't know.

44. A search engine such as Google, Yahoo, Altavista or Excite searches...

A). 984 (46.81%) Only some websites on the Internet.
B). 697 (33.16%) All of the websites on the Internet.
C). 400 (19.03%) I don't know.

45. A library catalog will allow me to find:

A). 389 (18.51%) Books, journals and other materials owned by the library.
B). 45 (2.14%) Citations to journal articles on a specific subject.
C) 502 (71.46%) Both A and B
D). 150 (7.14%) I don't know.

Appendix B:
Recommendations for Core Curriculum Education in Information Technology

Colorado Commission on Higher Education (CCHE) Recommendations for Core Curriculum Education in Information Technology (October 26, 2001 DRAFT)

Integrating technology competencies within the general education content areas.

A. Overview

Throughout the history of the United States technology has always played a significant role in the development of the country. In times of economic, national security and educational challenge, the country almost instinctively has turned to technology to resolve problems. Whether it was to meet the economic challenge of "manifest destiny", competing for dominance in space or educating the workforce that has enabled cyber technologies, technology has been a powerful force. It is therefore only natural that it should find its appropriate place within the foundation of a higher education curriculum, general education.

The General Education Technology Competency Working Committee recommends that "the integration of appropriate technology competencies and skill support the mastery of the content of general education. The use of technology should never suppress content or diminish the rigor of general education courses. It is understood that the useful and successful incorporation of technology into any curriculum requires appropriate technology support for both students and faculty.

Students will use appropriate technology in the five general education course areas of communication, mathematics, humanities, natural sciences, and social sciences to collect, analyze, evaluate, display and communicate the results of inquiry and to collaborate. In general education courses, students will develop proficiency with current technology and comfort with future technology in relationship to specific content areas.

Because technology has become pervasive, there are some basic technology skills that are expected of students. Therefore, general education courses may address technology through expected (remedial) skills and the use of these skills in the classroom. Other technological skills, especially those associated with specific technology tools associated with content areas may be acquired in general education courses. Since technology evolves rapidly the examples cited here are for illustrative purposes only. Table 1 illustrates examples of possible expected and acquired skills.

Skill Area	Examples of Possible Expected Technological Skills	Examples of Possible Acquired Technological Skills
Collect information	Internet and database searching	Database creation
Analyze and evaluate data	Use of formulas and graphing in a spreadsheet	Use of mathematical software tools (such as SPSS, Mathematica, and Scientific Notebook) or GPS (global positioning system)
Display data	Use of a word processor, spreadsheet graph, or presentation package	Inclusion of graph in word processor document or Web page creation
Communicate results and Collaborate	E-mail	Listservs, online systems (such as WebCT and Blackboard)

General education course syllabi will list the expected and acquired technological skills.

B. Administrative issue

It is essential that each institution take responsibility for providing technology infrastructure. Each institution provides both learner and faculty technology support appropriate for the application of the technology. Each

institution provides both learner and faculty access to appropriate technology. Each institution regularly reviews technology support systems to insure that they are effective.

Institutions need to provide students with information on how they can remediate if necessary.

C. Operating principles

The integration of technology supports the mastery of the content of the general education course. Technology competencies and skills are appropriate for the subject matter and the intended outcomes.

Each institution regularly reviews technology competencies and skills to ensure currency and effectiveness.

The acquisition of technology skills and competencies can be assessed.

General education technology competencies and skills support the content evolution of major fields of study.

Discussion synopsis and comments:

- What is the definition of technology and what are the goals of using technology? The term information technology may be too narrow. Perhaps goals of accessing information and allowing communication would be better. However, goals need to be specific enough to assess.
- Concern with technology/content. Technology should not drive content. However, appropriate technology should not be avoided in general education courses. Every course may not require technology. technology should be a by-product of general education classes.
- Our job is to come up with a specific list of primary skills and secondary skills so people coming up with general education courses can address where the skills fit. One school came up with 5 critical skills measured at 3 levels.
- Concern about trying to become all things to all people.
- Point that technological skill sets are dynamic, not static. At some point some course knowledge becomes ambient background knowledge.
- There is a wide spread of technological knowledge amongst incoming students. One school is surveying freshmen regarding technological skill level.
- Several people stated that if we'd had a better idea of the expectations of the conference, we could have better prepared and brought results of previous work in this area (such as Ready and Able and the 5 skills/3 levels that one school spent 3 years developing).
- Possible methods for remediation: Short courses, tutorials, and classes (both inside and outside of the institution).
- Expectations: One school has pre-service teachers do a self-evaluation of technology skills based on the required skills needed by teachers in Colorado. Accompanying the skills is a listing of remediation opportunities.
- Expectations: One school requires students to obtain the International Computer Driving License (ICDL) before being accepted into the business program. They can participate in a one-week boot camp prior to the fall semester. They pay for the boot camp and earn no college credit.
- Expectations: One school requires students to acquire technological proficiency by the end of their sophomore year. They can demonstrate proficiency by passing an exam or an approved class. The exam is based on the ICDL

Remedial Intervention

The committee recommends that all students enter college with a minimal level of "Technology Fluency". If those minimal levels cannot be verified then institutions should have established strategies for enabling students to achieve those minimal standards. Those strategies could range from a technology module included in the institution's orientation to a required non-credit course. To identify the minimal levels of competencies and skill the committee suggests that the **National Academy of Sciences** recommendations *Being Fluent With Information Technology* be adopted.

The general education content should not be compromised for the purpose of achieving minimal technology competencies and skill.

Appendix C:
Fluency in Information Technology (FIT)

From ***Being Fluent with Information Technology*** (1999) Computer Science and Telecommunications Board -- National Research Council
The entire content of the report is online at http://books.nap.edu/html/beingfluent/

The Components of Fluency with Information Technology

Intellectual Capabilities
1. Engage in sustained reasoning.
2. Manage complexity.
3. Test a solution.
4. Manage problems in faulty solutions.
5. Organize and navigate information structures and evaluate information.
6. Collaborate.
7. Communicate to other audiences.
8. Expect the unexpected.
9. Anticipate changing technologies.
10. Think about information technology abstractly.

Information Technology Concepts
1. Computers
2. Information systems
3. Networks
4. Digital representation of information
5. Information organization
6. Modeling and abstraction
7. Algorithmic thinking and programming
8. Universality (i.e., any computational task can be performed by any computer, however, computers differ by how quickly they solve a problem.)
9. Limitations of information technology
10. Societal impact of information and information technology

Information Technology Skills
1. Setting up a personal computer
2. Using basic operating system features
3. Using a word processor to create a text document
4. Using a graphics and/or artwork package to create illustrations, slides, or other image-based expressions of ideas
5. Connecting a computer to a network
6. Using the Internet to find information and resources
7. Using a computer to communicate with others
8. Using a spreadsheet to model simple processes or financial tables
9. Using a database system to set up and access useful information
10. Using instructional materials to learn how to use new applications or features