University of Washington Bothell
Computing and Software Systems (CSS)
Self-Study

for the following degrees

(1) BS in Computing and Software Systems (BSCSS)
(2) BA in Applied Computing (BAAC)
(3) MS in Computing and Software Systems (MSCSS)

Prepared for The Graduate School
Office of Academic Programs

March 25, 2008

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APPENDICES

SECTION A – GENERAL SELF EVALUATION

Background and Introduction

This self-study of the Computing and Software Systems (CSS) program at the University of Washington Bothell (UWB) focuses on its BS in CSS (BSCSS) degree, the only degree program that has actively enrolled students since the program's founding in 1996. Two other degree offerings have been launched more recently: MS and BA. The MS in CSS (MSCSS) degree was developed and received final approval in 2002, but has remained dormant for lack of funding. A second undergraduate degree, the BA in Applied Computing (BAAC), began enrolling its first students in September 2007, but has not yet achieved sufficient record for review. Nonetheless both degree offerings are considered to be strategically important for future growth of the program and thus are included in this self-study.

NOTE: Unless indicated otherwise, all of the statistics and other information presented in this report for the last 11 years will pertain only to the BSCSS degree program.

Because of its extended dormancy, the MSCSS degree was in danger of having its authority revoked under the "sunsetting" policy of the Higher Education Control Board (HECB) of Washington State. Upon request to the HECB in 2006, UWB was granted extended authority to offer the MSCSS degree through 2010. That extension included a HECB provision that CSS conduct a re-review of the program that would include updating of the curriculum, budget, and demand numbers before actual enrollment. Since the present program review was already scheduled for this year, the program was given permission by the UW Graduate School, with HECB concurrence, to combine the MS re-review with the present program review. Section F.2 (along with Appendices H, J, K) describe the MS degree and present the requested information updates, and it is requested that the review committee include an assessment of the relevant aspects of the MS degree proposal.

While science and engineering programs were proposed in general terms in the earliest UWB founding documents, one of the first specific references to the desirability of a computer science program at UWB was in "Design for the 21st Century: Expanding Higher Education Opportunity in Washington" (HECB, 1 July 1990, p 16). In 1993, a committee comprised of UWB and UWS faculty and industry representatives recommended establishment of a "Software Systems" degree that would focus on the development of applications software with attention to fundamental concepts and skills relevant to employment in the software industry. During the 1995-96 academic year, UWB requested special legislative funding for start-up of a BSCSS degree program and appointed a task force to define its curriculum. This task force, chaired by Bill Erdly, with representation from UWB, the Computer Science and Engineering Dept at UWS, and the local community college community paid particular attention both to addressing the needs of regional industry and to complementing undergraduate degrees already offered at UWS. Legislative support and HECB approval were obtained for start-up of the BSCSS in Autumn 1996.

Based on the fundamental disciplines of computer science and software engineering, a distinguishing feature of the CSS curriculum was its focus on the processes involved in the design, development, and implementation of software applications. Feedback from industry colleagues had indicated that graduates of such a degree program would fill valuable niches in the rapidly expanding regional economy. Therefore, the curriculum was intentionally designed to enable agile response to changes in this rapidly developing workforce sector. All of the students would be upper division majors, with the majority being admitted as community college transfers. Accordingly, considerable attention was given to assuring that the CSS lower division prerequisites meshed seamlessly with the preparation available at the regional community colleges. A hallmark of the BS degree program has been a required ten-credit capstone cooperative education course that most students would accomplish in collaboration with local industrial sponsors. This would ensure that the students' preparation was well aligned with the needs of regional employers.

In 1996, Professor Bill Erdly was appointed founding director of CSS, and Carol Zander was hired as the founding faculty member. After only a summer of recruiting, the first class of students was enrolled in September 1996, providing 15.3 full-time equivalents (FTE).

Fueled by the vigorous growth of the regional software industry in the late 1990's, enrollment in CSS grew rapidly, reaching a peak in excess of 203 full-time equivalents in Autumn 2000. While detailed enrollment data and trends are examined in this Section A.1, it is noted here that enrollment peaked out and then somewhat declined as the "dot-com" economy collapsed in the early 2000's, closely following the national trend in computer science related fields. Further following these national trends, enrollment of new majors in the BSCSS degree bottomed out after spring 2007 and has begun to rise once again in 2007-08.

Faculty growth was also rapid, expanding from the founding pair of faculty to a maximum of 9.7 full-time members, a number which as now shrunk to 8.7 FTE. Administration in CSS has been stable, with only three people serving as director since 1996, and only four different people filling the three professional and classified staff support positions since 2001.

With the construction of buildings UW1 and UW2 in the early 2000's, CSS was allocated sufficient laboratory space to serve its instructional and research needs, and finds itself well positioned for future growth and development.

Although the newest program at UWB, CSS has matured and developed from start-up to being an active initiator of strategic development. For example, the recently launched BAAC degree is the first completely new UWB baccalaureate degree (not an option or concentration) since 1997. As a second example, the MSCSS, although not launched due to lack of funding, is well poised to serve the region as it moves along the upswing phase of the high technology employment cycle. Both of these degrees were initiated by CSS as strategic and timely responses to the educational and workforce needs of the Puget Sound community.

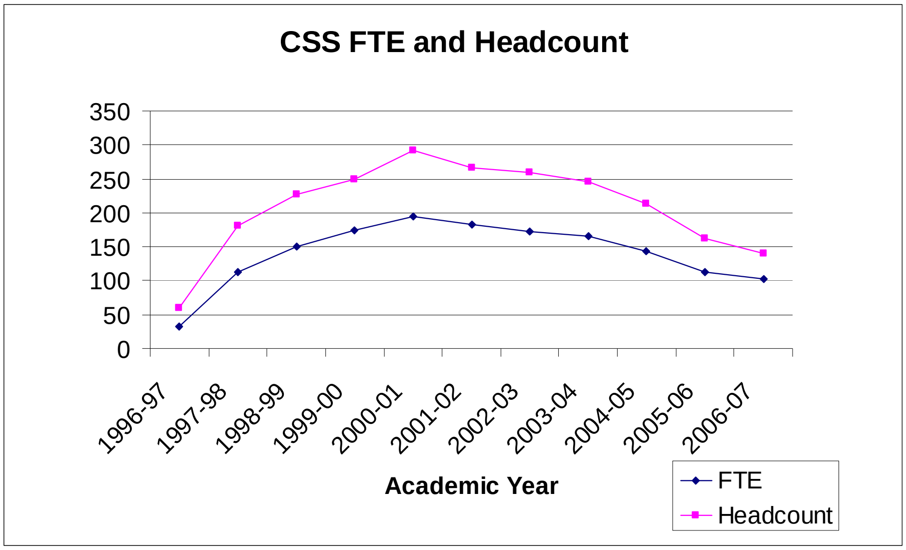
Although staffed with less than nine faculty members, the CSS program has matured into a regional leader in graduating well educated BS and BA graduates in computer software related fields. It has done this by developing a cadre of extremely successful faculty, and by recruiting a very capable student body that is highly sought-after in addressing the high technology workforce needs of the expanding regional economy. As UWB's only active science or engineering program, CSS is well-poised to provide leadership as the campus develops a comprehensive STEM (Science, Technology, Engineering, and Mathematics) presence in the regional educational landscape.

1. Areas of Strength and Success

A. Launch and Rapid Growth of BSCSS Program

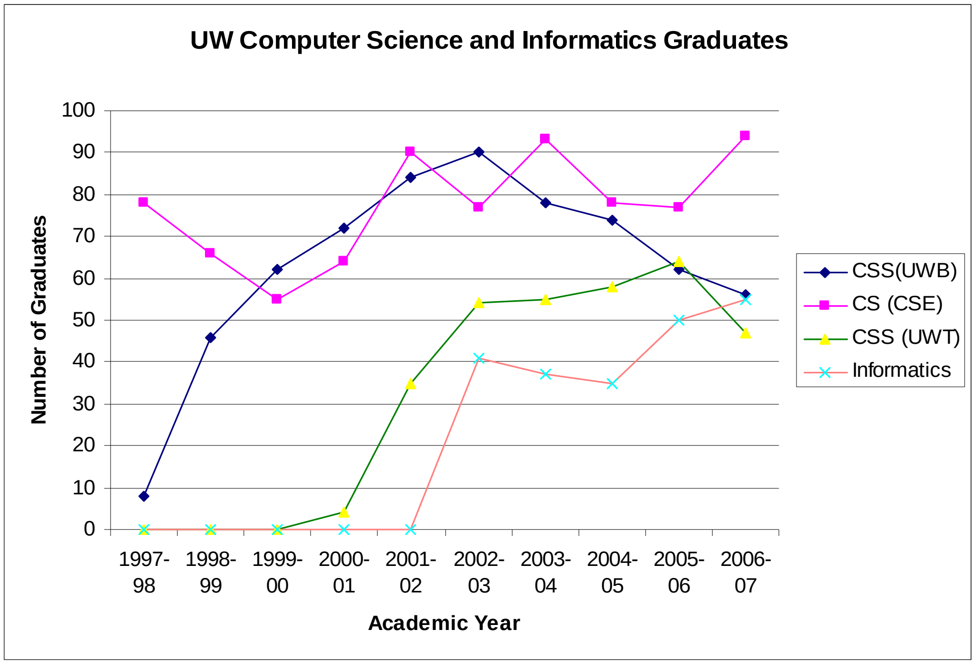
The greatest success of the CSS program over the past 11 years has been the successful launch of a new highly innovative undergraduate degree that has grown to become a very solid program that annually graduates one of the largest baccalaureate classes of computer science related students in the region. As shown in Figure A.1, the program grew from an annual average of 32 student FTE's in 1996-97 to a peak of 194 FTE in 2000-01. Following the national trend, the enrollment declined as the "dot-com" economy collapsed and retrenched in the early 2000's.

Figure A.1: CSS FTE and Headcount



One measure of success of the program is, of course, the number of well prepared students it has graduated. Figure A.2 shows that the number of graduates in CSS (UWB) followed a pattern similar to that of its total enrollment, peaking in the 2002-03 year and then gradually declining.

Figure A.2: UW Computer Science and Informatics Graduates



While the four related UW programs have significant variation in their graduation rates, we note that CSS is a very significant source of UW graduates every year and in 2002-03 had the largest group within the UW system. The average number of graduates for the various programs is reported in the Table A.1. For the newer programs, we have used shorter time range averages that reflect their mature size. Table A.1 shows that on the average, the BSCSS at UWB accounts for approximately 29% of the UW graduates and is second in size only to the CS program at the Seattle campus.

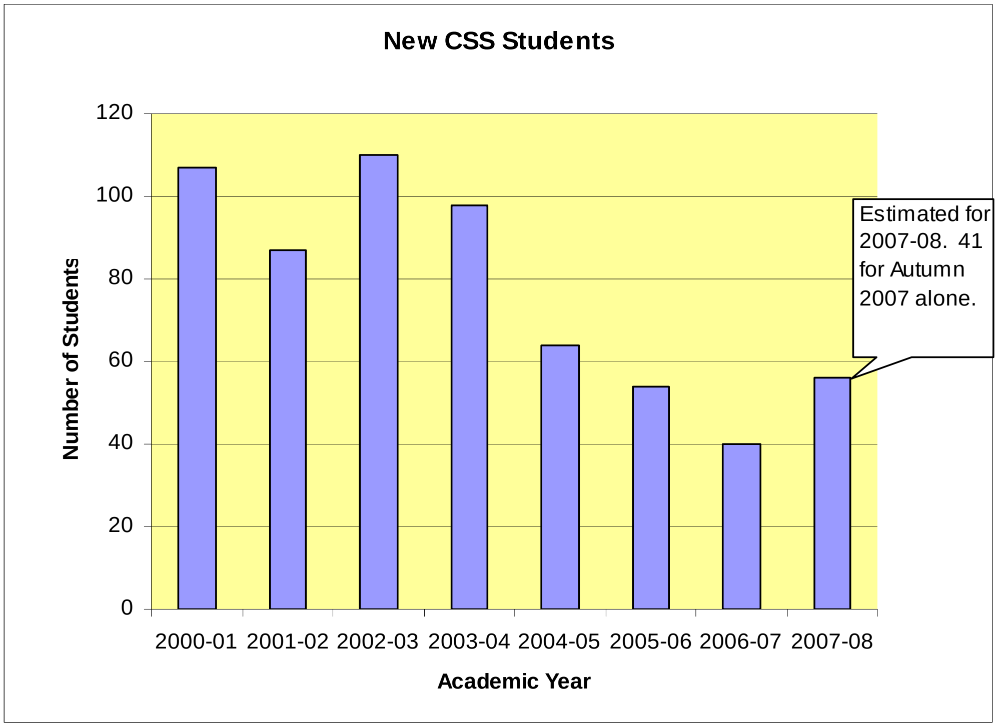
Table A.1: Graduating student averages by program

Program Name	Range of Average	Average # of graduates
BS in CSS - UWB	1999-2007	72.2
BS in CS - UWS	1999-2007	78.5
BS in CSS - UWT	2002-2007	55.6
BS in Informatics - UWS	2002-2007	43.6

Clearly, CSS at UWB is a major contributor to the efforts of the UW to address the student and community desire for a high quality education leading to a well-trained workforce in computer science related areas.

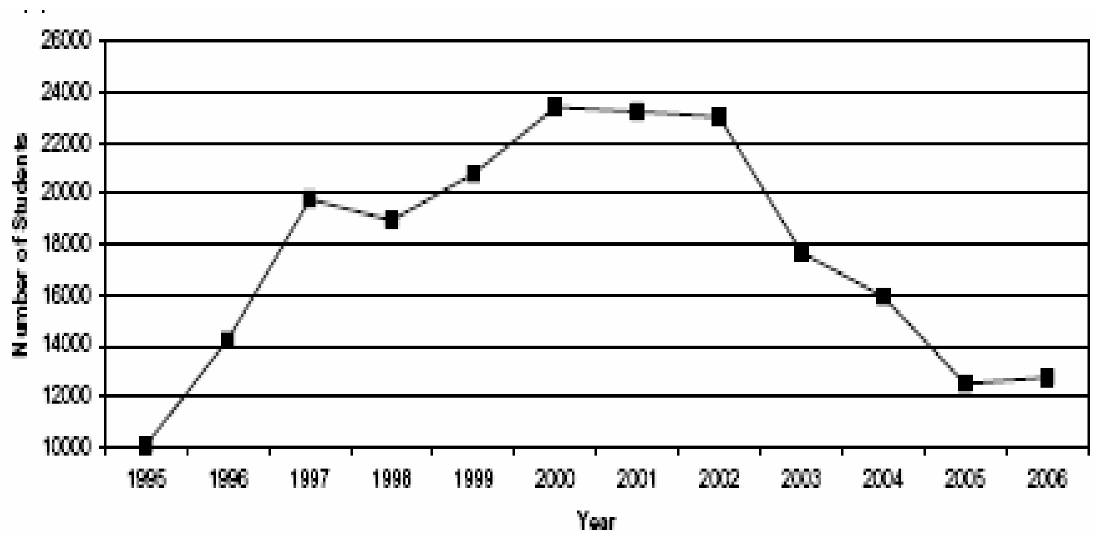
However, the declining enrollment pattern, even though mirroring a much larger national trend, is of concern. To examine admission trends, we present in Figure A.3 the total new admissions as a function of time.

Figure A.3: New CSS Students



Until Autumn 2007, the number of new admissions had shown a steady decline since 2002. In Autumn 07, a clear reversal of this trend was observed with the admission of 41 new students. Combined with approximately 20 students in the Spring '08 cohort, we have estimated a total of 56 new students for 2007-08. This is a clear reversal in the long term trend and indicates to us that the students have begun to respond to the upswing in the high technology employment sector. An indication that this is not just a statistical fluke in our small group of students is provided by the national data due to the Computer Research Association that shows the number of newly declared CS/CE majors rising in 2006 for the first time since 2000 (See Figure A.4 borrowed from a CRA Survey).

Figure A.4 Newly Declared CS/CE Undergraduate Majors[1]



As an upper division program that admits students 1-2 years after they realize their interest in computer science and software, CSS would expect to trail the national data by one year. Because this data, involving thousands of students, so closely tracks our own, we are confident our "reversal of fortune" is significant and likely to persist.

B. Success in Faculty Growth and Development

As can be seen in Appendix D, the faculty of CSS has grown from its initial two full-time faculty (Erdly and Zander) to a group of nine full-time and three regular part-time faculty, whose areas of expertise and scholarship span the range from computer science to software engineering, to varied areas of computational application, and to computer science pedagogy. All of the full-time lecturers have been appointed on renewable long-term contracts. All of the tenure-track faculty have achieved tenure, and one of those (Cioch) who joined CSS as an associate professor has been promoted to full rank. Of the six individuals appointed as assistant professor over the years, three have been promoted and tenured, two resigned very soon after coming to UWB to seek other careers, and only one resigned without achieving tenure after remaining with CSS for more than four quarters. This high success rate of our faculty in achieving promotion and tenure is indicative of an environment that fosters professional development and encourages scholarship that is feasible in the UWB setting. Among the many successes of the CSS faculty, two awards of particular distinction are the 2002 UW Distinguished Teaching Award (Carol Zander) and a 2005 NASA Space Act Award (Clark Olson). We note that although computer science is notorious for its faculty being somewhat hard to obtain and retain, our faculty lines have all been filled since 2001 by the same faculty who now hold them. CSS is noted for its faculty stability.

Examination of the usual external metrics for faculty success shows a picture of success as well. Table A.2 shows the number of peer reviewed publications, scholarly presentations, and external funding levels for the past five years.

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[1] CRA Taulbee Survey 2005-2006, Fig 7, p. 22-23.

Table A.2: CSS Publications, Scholarly Presentations and External Funding

External Metrics by year	2002-03	2003-04	2004-05	2005-06	2006-07
Publications	17	18	17	25	19
Scholarly presentations	11	19	11	17	10
External research funds	$127,646	$121,646	$105,300	$105,300	$145,300

While it is difficult to find comparative data of this type appropriate for undergraduate departments, it is easy to see that the CSS faculty are active, productive, and successful in funding their scholarship. The program has been successful in attracting strong faculty members and in fostering their professional development.

C. Strength in Curriculum Development and Innovation

From its inception the BSCSS curriculum has been innovative and relevant to community needs, having been designed by task forces that drew directly upon industry input. The curriculum and program were intended to be sufficiently agile to respond quickly to changing needs in the regional community. An outcome of that design was the intentional decision not to seek accreditation, which was thought to sometimes make curricula less agile and less likely to evolve rapidly in response to changing needs. An example of this desired agility was the program's ability to adapt to changing needs by restructuring the BS curriculum (in 2001) from a single degree with three well-defined concentrations to a degree with a very broad range of electives that allow the students to more flexibly customize their education in accordance with their interests and employment sector needs.

Beyond the design of its curriculum, the philosophy of CSS (and of UWB) was to be broadly responsive to community needs. In response to the large number of college graduates in this region who wish to return to school to gain 2nd degrees in computer science and software engineering related areas, the program developed a proposal for the MSCSS degree, which was fully approved in 2002. One of the strengths of this degree is that it is designed to serve students whose previous degree was in non-CS areas as well as those with BSCSS degrees or CS. The concept was in direct response to expressed needs of local industry and of the people working in it. For lack of funding, the MS has now remained "on the shelf" for five years.

We began tracking the number of e-mail inquiries regarding a master's degree in October 2006. In May 2007, an informal e-mail was sent to CSS students and alumni regarding interest in the Master's of Science in CSS degree. Overall, 20 current students and 27 alumni responded that they would apply for the MSCSS degree. Of the 27 alumni, 24 work for companies that would pay for their tuition. As of November 1, 2007, there have been 45 *unsolicited* e-mails from prospective students. As you can see, even while on the shelf, the concept of the MSCSS is shown to be successful, as a significant number of prospective students have inquired about it and its launch date. However, it is equally clear to us that the public impression of UWB and CSS are not enhanced by a five-year delay in launching an approved program that is of considerable community importance.

Having experienced the frustration of trying to launch a new degree program that would be in great demand by the high technology community and seeing it stall for lack of resource commitment, the faculty turned to devising a BACC that could be offered within the present resources. The BA degree is aimed at the increasing need for workers trained in application of computers to specific knowledge domain areas, such as bioinformatics or educational technology. This BA degree requires the student to take a cluster of courses in the applied domain area in addition to a strong computer software systems foundational education, and to combine them in an integrative capstone exercise. The BA degree was approved in midsummer 2007 and enrolled its first students in Autumn 2007. All indications are that it will be increasingly successful as the broader UWB context develops a rich set of “minors” and course clusters in interesting application areas.

In Autumn 2006, UWB was instructed to begin lower division admissions and instruction with little advanced preparation and planning. The campus decided to provide the lower division curriculum as a mix of the usual disciplinary foundational courses and interdisciplinary “discovery core” courses for first-year students. The CSS faculty responded by investing itself heavily in this new activity. In the 2006-07 year, the CSS faculty staffed three discovery core courses, two calculus courses, a complete sequence of introductory programming courses, and an information fluency course for non-majors. This involvement has continued in the 2007-08 year and beyond.

In summary, in only 11 years, the CSS program has successfully launched its initial BS degree, revised that curriculum based on experience, expanded into an interdisciplinary BAAC, taken responsibility for a wide range of the new lower division curriculum, and developed a yet-to-be-offered MS degree to serve the working professionals in the high technology sector. Clearly, flexibility and innovation in curriculum is a demonstrated strength of the CSS program.

D. Student Success

Students and alumni of the CSS program have been highly successful as demonstrated by their academic and professional achievement, their satisfaction with the program as indicated on surveys, their involvement beyond the classroom with the program, and their employability.

A major part of the program’s success can be attributed to the senior capstone project (CSS497). The program developed a robust, experiential senior project to establish students and alumni in a new category of computing professional that was valuable to industry, but that fell beyond the scope of the traditional disciplines. The Cooperative Education (CE) requirement, a 10-credit (400 hours) capstone project, is the final core requirement for all CSS students. Most students elect to complete their capstone project through an internship within the local industry, although a few choose to do undergraduate research instead. During the internship, students work in academically relevant, supervised positions enabling them to integrate classroom theory with practical work experience. Students gain an impressive resume of practical work experience, and employers find motivated, well-prepared students who excel as student employees and as future hires after graduation. Industry sponsors vary from small, local firms to multi-national corporations, government agencies and non-profit organizations.

Examples of recent CSS497 project titles include the following:

- Cell Phone Software User Interface Development
- Maintaining and Development of the Panasonic Maintenance Services Aircraft Media Loader
- Multi-Image Wide Baseline Stero Vision

- Parallelization of a Software Source Code Correlation Program
- Development of Liquid State Machines as a Model of Cortical Cultures
- Integrated Aircraft Noise Prediction Model and Measurement Software
- Blades3D Game Engine Development
- Enhancing Communication and File I/O in AgentTeamwork

CSS students have been placed in a broad range of industries for their senior project, and many of them have been offered full-time positions at the end of their internship. While students intern at more than 300 different organizations, some of the better known companies participating in the CSS senior project internships include the following:

- Microsoft
- Boeing
- Amazon
- Google
- Her Interactive
- Philips Medical Systems
- Siemens Medical Solutions
- ELDEC-Crane Aerospace
- Fluke Corporation
- Honeywell International Inc.
- Intel

CSS graduates have also been accepted to graduate schools including the following:

- UW CSE Professional Master's Program
- UWT CSS Master's degree
- UWB MBA
- UW Law School

Students come to the program well prepared in math and science, and many of our core courses require that students apply these concepts. In the 2007 UWB Survey, CSS students indicated a high level of satisfaction in academic outcomes, including defining and solving problems, understanding and applying scientific principles and quantitative principles, and working with modern technology. As another indication of a high level of student satisfaction, 90% of CSS students surveyed evaluated the educational experience at UWB as excellent or good. Likewise, the 2007 National Survey of Student Engagement survey shows a high level of satisfaction with internship and practicum opportunities.

To build a sense of community, the program has involved our students actively in recruiting, peer mentoring, and holding celebrations and conferences (e.g., the CSS 10th Anniversary

Celebrations and conferences are held at UWB). The Association of Computing Machinery (ACM) student chapter is active, creating social activities, career events, and sponsoring industry recruiters, and there is an active CSS alumni group. In 1998, the UWB student chapter won the national ACM outstanding activities award for the *Future of Women in Computing* conference (for girls aged 7 to 17).

In addition, the director meets quarterly with CSS students in "Conversations with the Director" where they chat informally, allow emerging issues to surface, and entertain student suggestions. In addition, the CSS department has recently created a study hall to build a collaborative group for women.

CSS supports a strong research culture that engages students in undergraduate research projects. For example, besides the undergraduate research projects resulting in published papers or conference presentations mentioned earlier, Prof. Fukuda has involved students in international research opportunities at Ehime University in Japan. Several students from UWB have attended Ehime University and several students from Ehime University have attended UWB due to this collaborative international research opportunity.

E. Strong Community Connection

The program has been very successful in maintaining close relationships with the community it serves and in which our graduates seek employment. Examples are given here of our connection with both the regional employment sector and the educational system from which our students originate.

It is important to a program serving students who largely intend to pursue employment in the surrounding industrial community to remain tightly coupled to that community. From the beginning, community input was actively solicited in formulating the CSS curriculum. Through the 11 years of the CSS program, over 600 CSS seniors have carried out cooperative education projects with external sponsors in the workplace (i.e., their senior capstone project, CSS497). Between Summer 1997 and Spring Quarter 2007, CSS students have completed 645 internships at over 317 internship sites, which include 268 industry, 49 non-profit. Every one of these projects connects a working professional serving as a sponsor with both a CSS faculty member serving as advisor and a CSS student.

The students present their cooperative education final project reports in quarterly public colloquia commonly attended by external internship sponsors, prospective employers of our graduates, and by prospective students learning about the program. Each external sponsor is given a personal invitation from the director to attend the colloquium and participate in the review of the student presentations. Besides giving the program significant community interaction and publicity, this participation at our colloquia provides us with a valuable source of information concerning the relevance of our students' education to the workplace. Appendix I contains letters recently received from local industry commenting on the quality and preparedness of CSS students and the importance of the CSS program to the regional technology sector. Many of those letters are informed by interactions with our cooperative education project students.

In addition, through annual meetings between CSS faculty leadership and the computer science faculty of each of our six most significant feeder community colleges, the CSS program has remained very firmly connected to the institutions and individuals responsible for the lower division preparation of the majority of our students. The sites of these one-on-one meetings alternate between the community colleges and UWB and give us a chance to report to each college on the progress of their recent graduates. They also give us the opportunity to exchange first hand information about our curricula and to explore ways that they can mesh more seamlessly.

Finally, in order to obtain a higher level of input from the regional community, the CSS program has organized a Community Advisory Board, comprised of individuals from industry, government, and nonprofits who are interested in the relevance of our program and the education of our students. This board will conduct its first meeting during Spring 2008 and will be tasked with helping the program define the scope of its role in the upcoming development of STEM programs at UWB. Expressions of community support are found in letters in Appendix I, while Appendix E contains a list of local employers of our graduates.

2. Measures of Success

Some of the measures of success for the CSS program have been discussed above. In this section more detailed analysis is provided where appropriate.

A. Student Body

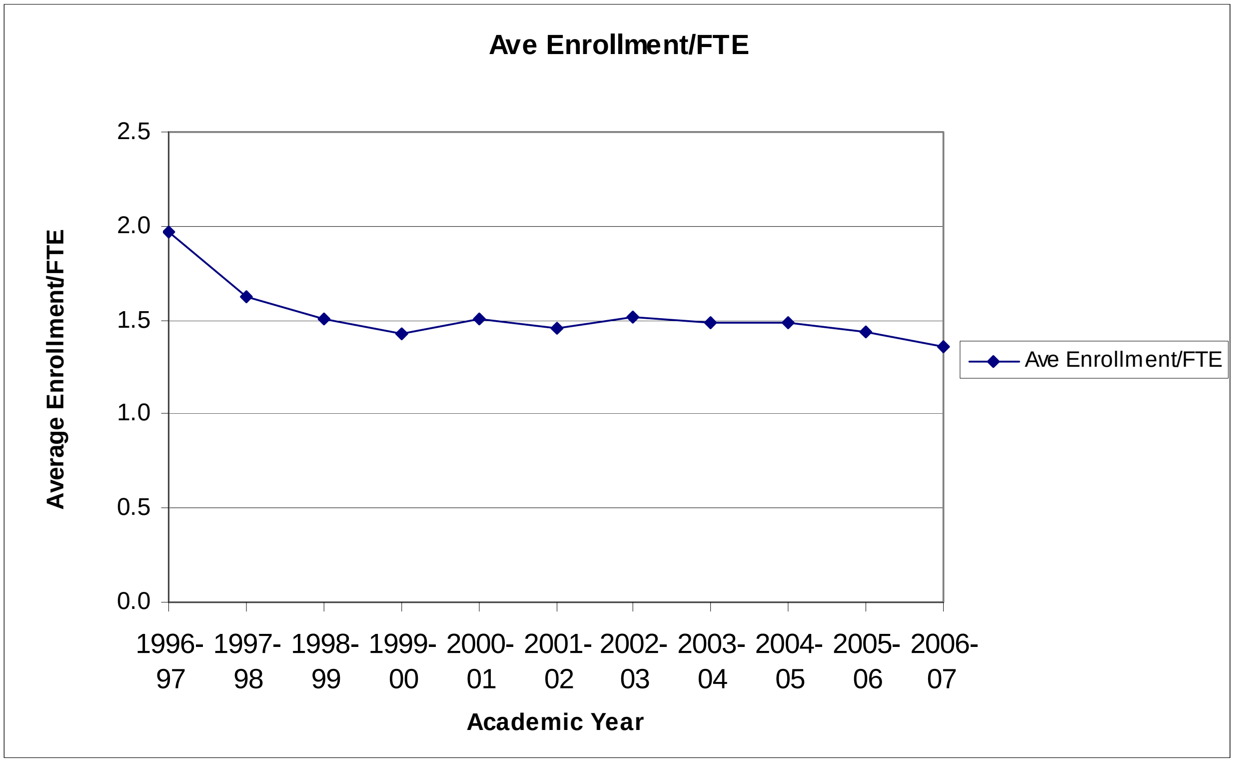
We have mentioned that the number of students in CSS grew rapidly, peaked at a headcount in excess of 300, and has gone through a decline and recovery that mirrors the national trends for the field. Throughout this process, the CSS program has remained a very significant player in the computer-related education picture of the region.

Here we considered measures of success in student recruitment other than their numbers.

Examination of the zip codes for our students' residences shows that we are attracting students from the entire central Puget Sound region, but in particular the majority (64% of our students) comes from the north end and eastside of King County and the south end of Snohomish County. With a similar CSS program in Tacoma and the well established CSE program at UWS, this is the area that the UWB CSS program was intended to serve.

The fraction of part-time (mostly working) students in the CSS program was very large at first, with an initial headcount to FTE ratio of approximately 2. As can be seen from Figure A.5, this ratio in recent years has settled to approximately 1.4, indicating a strong ongoing presence of working students.

Figure A.5: Average Enrollment/FTE

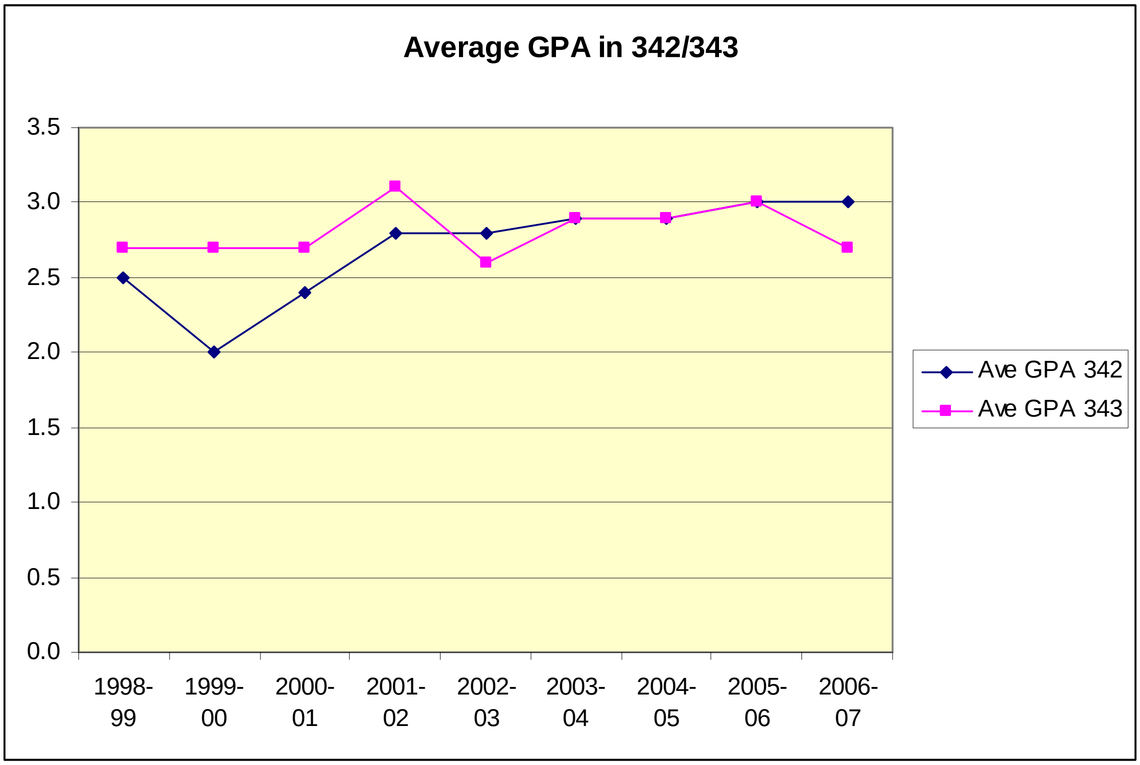


Approximately 25% of our students completed high school more than four years before entering UWB and truly are "returning adult" students. Taken together, this data indicates that, not only has the BSCSS degree grown to become a very large regional program, but that it continues to serve the time- and place-bound students who have traditionally been a focus of the UWB mission.

B. Student Success

The state-mandated metrics (discussed in Section F.3 "State Mandates") are one indication of student success, but with a focus on institutional efficiency. To focus more closely on the students themselves, we consider their success in the first two programming courses taken after transfer to UWB. These courses (CSS 342 and 343) have traditionally been the ones that students may have to repeat or, in some cases, caused them to withdraw from the program. Figure A.6 shows the average grade awarded at first attempt in both CSS 342 and 343 as a function of year. The CSS 343 grades show some variation, but have an average of 2.8 without displaying a significant ($p=0.43$) long-term trend. In CSS 342, however, there is clear improvement over the nine-year period, with a linear trend showing an average increase of approximately 0.1 grade point per year. ($r=0.83$, $p=0.006$).

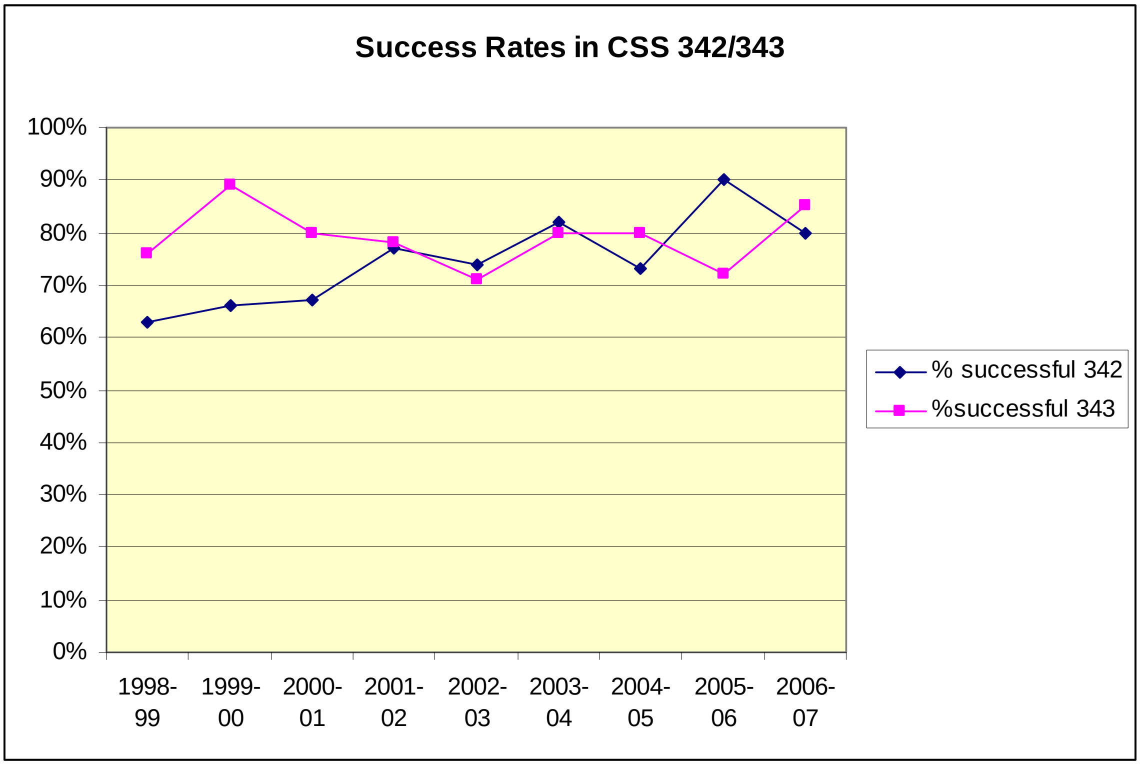
Figure A.6: Average GPA in 342/343



Another measure of student success would be the fraction of students succeeding on their first attempt in obtaining the required grade of 2.0 in these CSS courses. Figure A.7 presents data showing the rate of success in CSS 342 and 343 at first attempt as a function of year. The data for CSS 342 show a clear linear trend ($r=0.83$, $p=0.006$) with an increase of 2.6% each year. The success rate in CSS 343 does not display a significant ($p=0.79$) longitudinal trend.

By both measures, the student initial success in the CSS program (i.e., CSS 342) has improved steadily over the last nine years. The success of our students in the late 1990's was considered too low by the CSS faculty. A decision was made in the 2000-01 period to be more diligent in scrutinizing the lower division preparation of our students and to require a second course in calculus as one of the admission prerequisites. These responses to the serious problem of low success had a dramatic effect, as shown by the data, with the success rate in CSS 342 rising steadily to reach approximately 80%, which the faculty considers satisfactory.

Figure A.7: Success Rates in CSS 342/343



Besides the state mandated efficiency measures for the BS degree (see Section F.3), one of the most important measures of success from the students' point of view is the preparation of its graduates for employment. At the time of their final presentation of their CSS 497 capstone projects, the graduating students are given the opportunity to complete an exit survey. Most students are at this stage within 1-2 quarters of actual graduation, while a few are as much as three quarters before their graduation. In Table A.3, it is seen that with a fairly high percentage of students responding, the fraction having jobs one or more quarters before graduation is higher than 80%. Hiring commitments prior to graduation are a clear indication that the employment sector finds CSS students to be very attractive entry-level college graduates.

Table A.3: CSS Undergraduate Survey completed after CSS Colloquium

School Term	**Have a job and are graduating**	**Have a job and will graduate in 1 quarter**	**Have a job and will graduate in 1+ quarters**	**% students participating**
Autumn 2004-05	64%	68%	62%	80%
Autumn 2005-06	71%	74%	67%	90%
Autumn 2006-07	73%	72%	82%	88%

C. Faculty Success

The standard measures of faculty success are metrics such as the number of scholarly presentations, the number of refereed publications, student evaluations of teaching, etc. As noted above in Section A.1.b and Table A.2, the publication and presentation rate as well as the external funding for research has been quite high for a faculty of only nine individuals. In Section C, we present further analysis including a citation analysis that displays the significant impact of the CSS faculty scholarship.

The CSS program generally requires evaluation of every course taught using the standard UW student assessment survey. The results presented in Table A.4 are reported medians for the four “general questions” that are common to all forms of the survey instrument. For comparison, we have assembled data for all 100, 200, and 300 level CSS courses during the 2006-07 academic year, along with similar data for the entire College of Engineering. We believe this is probably the most appropriate set of comparison data, since it involves a large number of comparable science and engineering courses. Courses at the 400-level were not included for comparison because they typically involve a wide variety set of formats, topics, and educational objectives that make comparison difficult. From Table A.4, it can be concluded that student satisfaction with CSS instruction is comparable to that of the College of Engineering, and that the CSS faculty are having as much success in this regard as their colleagues in similar disciplines.

Table A.4: Overall median scores for student evaluations comparing College of Engineering (COE) and Computing and Software Systems (CSS)

	Autumn 2006		**Winter 2007**		**Spring 2007**	
	COE*	**CSS****	**COE***	**CSS****	**COE***	**CSS****
1. The course as a whole was:	3.8	3.6	3.7	3.7	3.8	3.9
2. The course content was:	3.8	3.6	3.7	3.7	3.8	3.8
3. The instructor's contribution to the course was:	4.0	3.7	4.0	4.0	4.1	4.2
4. The instructor's effectiveness in teaching subject matter was:	3.9	3.3	3.9	3.9	4.0	4.0
COMBINED ITEMS 1-4	3.9	3.6	3.8	3.8	3.9	4.0
Average number of respondents	3483	118	3387	89	3061	71
*College of Engineering 100, 200, 300 Level Courses						
** Computing & Software Systems 100, 200, 300 Level Courses						

D. Staff Services Success

The CSS program is staffed and funded to provide only academic advising, coordination of the cooperative education program, curriculum development support, and administrative services within the office. Besides this myriad of tasks, the CSS staff members have increased their scope of responsibility to provide student recruitment, public relations, admissions, and career counseling in ways appropriate to a STEM program. As the lone STEM program at UWB, the CSS program staff must themselves provide many of the services that must be tailored specifically to technical students. This represents a serious stretching of staff resources for a program staffed at a level comparable to the others on campus, but having the additional specific need of serving a student body in a technical field.

The staff has over the past several years become increasingly more involved in recruiting students. CSS is represented by the staff during UW Majors days with classroom presentations, or group presentations for science and engineering majors, Community College Advisor workshops, and classroom presentations at community colleges provided by the computer science faculty on a rotating basis. Admission advising by e-mail, phone, and in-person has increased due to the stepped up recruiting activities. Advisors are in contact with between 8-15 prospective students weekly, compared to 1-2 students prior to their extensive recruiting efforts.

Our program coordinator is responsible for administering the cooperative education course and exploring senior project possibilities with students. This includes faculty research, individual projects, group projects, and internships. The coordinator facilitates the senior project process, a quarterly CSS Colloquium, and follow-up with students. Besides the internship coordination, the program coordinator is responsible for the administrative assistance with academic personnel issues (such as faculty searches and P&T dossier support), budget matters, preparation of letter and administrative reports. CSS has supported successful staff awards nominations for our program coordinator.

Reception duties are shared by the program coordinator and one of the advisors. Our newest full-time employee began as a program assistant. She became interested in advising students, and the program gave her the opportunity to learn and grow. As a result, last year after four years of increasing her duties she was promoted to an academic advisor intern with lead responsibility for advising the BAAC students. Besides advising and recruiting, she is in charge of the peer mentoring program, the staff organizer of the CSS Speaker Series, and was the staff administrator for major CSS functions, such as the CSS 10^{th} Anniversary Celebration and the 7^{th} Annual Conference for the Consortium for Computing Sciences in Colleges Northwestern Region, and was the administrative support for the UWB Business Director Review Committee. She is also the editor for the CSS Newsletter and the CSS webmaster.

The senior CSS advisor is the lead advisor for the BSCSS degree (recruiting, retention and student success), responsible for the office operations, assisting the director with budget planning and time schedule planning and provide curriculum support. Projects include being the staff lead on CSS degree program, the BAAC degree proposal, the Master's in CSS degree proposal, coordinating with Community College computer science faculty, and science, technology, engineering, and math (STEM) planning at UWB. This advisor is responsible for gathering statistical data for projects within CSS including the 10-Year Self Study. CSS allows flexible work hours for this staff member to complete her Masters of Arts in Counseling Psychology degree.

E. Community Service

One measure of a program's success should be the extent to which it reaches out to, and serves, the community. Within CSS, the most notable outreach service activities are the Cooperative Education projects that are situated in various nonprofit organizations. Table A.5 indicates the number of such projects over the last ten years providing information technology services to the categories of governmental, church, and charitable organizations. A major component of this service activity has been the CSS presence in the technology development project that has provided a myriad of social, educational, and development opportunities to the Tulalip Indian Nation at Marysville, WA, where 27 projects (mentored by Professors Erdly and Kochanski) have been sited during this period.

Table A.5: CSS Community Service Projects 1997-2007

	Government	Charitable Organization	Church
Number of Projects	111	37	3

In 2002, as a service to students and the broader community, the program created the CSS Speaker Series that serves two important roles: enriching the students' education and providing a continuing education link to our alumni and surrounding community. The series sponsors guest speakers from a vast range of areas, encompassing aspects of manipulating and creating digital technology, nanotechnology, software project management and computer graphics and animation. The Speaker Series is funded by both the CSS program and the Campus Events Board. Each year (autumn to spring quarter), CSS sponsors a series of 6-8 outside speakers culminating in a major keynote address on a broadly important topic by scientist of national distinction. Table A.6 summarizes the Speaker Series for 2007-08 as an example.

Table A.6: CSS Speaker Series for 2007-08

Speaker	Topic
Dr. Pieter P. Tans, NOAA Earth System Research Laboratory	Tackling the Climate Change Problem: We Cannot Afford to Wait
Dr. Hairong Kuang, Senior Software Engineer, Yahoo	Take an Internal look at Hadoop
John Nordlinger, Microsoft Research, Microsoft	The Ethics of Computer Game Design
Dr. Ruth Anderson, Computer Science & Engineering, University of Washington Seattle	Digital Ink and Interaction in the Classroom
Dr. Janusz Kowalik , Visiting Professor, Informatics Institute at Gdansk University, Gdansk, Poland	Parallel Computers and Programming
Dr. David Notkin, Computer Science & Engineering, University of Washington Seattle	Unconventional Views on Conventional Wisdom about Software Engineering Research
Dr. Carol Zander, Computing & Software Systems, University of Washington Bothell	Can Graduating Students Design Software Systems?

In addition, in 2005, Carol Zander chaired the Consortium for the Computing Sciences in Colleges Northwest Conference at UWB. The conference, which focuses on computer science education issues in higher education, brought recognition and visibility to both the CSS program and UWB.

3. Program Weaknesses

A. Weaknesses Inherent to the UWB Context

In many ways, the greatest structural weakness of the program is the lack of a broad STEM context at UWB. Science programs function best in a rich milieu of STEM degree programs that attract a body of students with those interests. The students who are eventual majors in a particular science or engineering discipline may be attracted to the campus because of its broader STEM setting and then choose a particular STEM major after arriving. This broader context not only attracts more students with STEM interests, but allows for a richer set of supporting courses and services that are appropriate to STEM student interests and needs. It also provides an environment more likely to facilitate interesting interdisciplinary approaches to complex scientific and engineering questions. The UWB context, with CSS being the only STEM related academic unit, provides the program and its students with some serious challenges.

As one example, without registering at a different campus or university, a CSS student presently cannot take courses in multivariable calculus or differential equations, which are two math courses that should be available as electives to any serious science student. As another example, a student interested in scientific computing or computational science cannot receive a strong education in the fundamental science that would accompany their computer science education. These limitations make a major in CSS much less attractive to capable prospective students who are choosing between UWB and other campuses with well developed STEM contexts. As the only STEM program at UWB, CSS has the burden of attracting students interested in computer science even though the severe limitations of the supporting STEM context are very evident to them. Students are reluctant, for example, to matriculate at UWB when there are no other STEM majors from which to choose should they lose interest in CSS. While other universities are extolling the range of choices and flexibility they provide their STEM students, we have been largely limited to promoting a single BS major.

CSS has recently developed a BAAC degree that will offer some degree choice within CSS to STEM students. It requires a minor in an applied area to accompany the major courses taken in computer science and software engineering. But, the success of this initiative will be developing slowly because the number of interesting minors available on campus is quite limited.

Another structural problem is the difficulty all UW students have in cross-campus registration. If we could solve that administrative problem, making it easier for our students to mix CSS related courses with their interests in the many application domains (at other campuses), we would probably increase the interest in our BA program considerably.

Although much about the UWB context is highly supportive of good faculty development, one major cause of concern is the extraordinary burden of institution building and campus leadership that falls upon our mid-career faculty. As a young faculty with less than 25% (18 of 76) at rank of full professor, many individuals assume leadership roles at a career stage more commonly devoted to maintaining their initial successes in research and teaching.

B. Weaknesses Inherent to the CSS Program

Looking to weaknesses that are rooted within the program rather than in the campus more generally, virtually all of them arise from the program’s mission to provide a very broad set of academic programs to a very diverse group of students with a very small faculty and staff. This situation has to a large degree arisen from strict institutional metrics relating faculty and staff levels to the number of full-time equivalent students. For example, until recently faculty staffing has been at a ratio of 20:1 with respect to FTE students and support staffing has been roughly at 4:1 with respect to the number of faculty. Neither ratio had any explicit basis in the instructional, research, or support needs of a computer science-related program, but were derived from campus-wide metrics that were applied uniformly to computer science, business, social sciences, arts, and the humanities. Meanwhile, the mission of the program has expanded to include a second degree (BA) and a lower division program, without any increase in staffing to accommodate them. In fact the CSS staffing level has decreased by one permanent faculty line over this period of expanding mission, a consequence of applying metric-driven logic to a discipline with cyclic enrollment patterns.

The weaknesses arising from this staffing model are described in the following subsections.

1. Insufficient Faculty Breadth

No computer science or software engineering program at a smaller, non-doctoral institution can hope to have the breadth of faculty available at a large Research-I campus, nor would that be necessary. However, reasonable breadth and balance of the faculty across the various curriculum emphases needs to be maintained for a high quality educational experience. The CSS curriculum is divided somewhat evenly between software engineering and computer science related courses Because of the emphasis on the software application development process, the computer science courses represent only 50% of our upper division core curriculum and 45-60% of our upper division elective courses.

At present, the permanent full-time faculty could be described as follows (see Appendix D):

- five in computer science (Sung, Stiber, Olson, Fukuda, and Zander)
- two in software engineering (Cioch and Erdly)
- one materials scientist (Berger)
- one computational chemist (Jackels)

Considering the program emphasis on software engineering, database management, human computer interaction, and IT business and management principles and skills, it is clear that the program requires more than two of its nine faculty in those areas. The needed breadth to staff our courses has been achieved by employing two regular part-time lecturers (Kochanski and Anderson), assigning computer scientists to courses in database management (Olson) and technical communications (Stiber, Zander), and assigning a physical scientist (Berger) with industrial management experience to teach one of our business principles courses. While this has worked well thus far, the arrangement is highly vulnerable because it depends critically on the availability of two very capable part-time faculty, whose availability should not be taken for granted.

Despite all of this flexibility and “stretching,” a very important “hole” in our staffing breadth persists in the area of human computer interaction, an area of critical importance to our students who are training to design effective software applications. A person with such expertise was an early priority of the program, resulting in the appointment of Baili Liu in 2000. However, when Professor Liu resigned in 2006, her position remained empty and the line was lost to CSS. While Prof Erdly and adjunct faculty have managed to staff the bare minimum of a single course in HCI, the lack of such a specialist on our faculty is a major deficiency. Such a person would not only provide advanced electives in HCI, but would serve the software engineering curriculum more broadly. The shortage of software engineering faculty has limited our ability to provide courses in important areas such as software testing, design principles for secure software, and user testing.

2. Low Faculty Salaries

In general, it is difficult to keep university faculty salaries sufficiently in touch with market forces to remain competitive in attracting new faculty and retaining the most accomplished of the present ones. It is well documented that UW has fallen substantially behind its peer institutions, and CSS at UWB is no exception to that trend. We note with appreciation recent efforts by the administration to provide raises across the UW units somewhat in excess of the ordinary minimums. It must be considered a program weakness, of course, that our salaries are not keeping up with the market place in computer-related professions. Thus far, that weakness has been masked because, in six years, we have not hired a new faculty member, which is the occasion of direct interaction with the market place. We hope that the administration efforts will, over a number of years, bring UW salaries more in line with our comparison peer group and allow us to be competitive when we have the opportunity to hire new faculty.

Of more immediate concern is the fact that the CSS salaries at UWB have during this same period also fallen increasingly behind those of our colleagues in CSS at UWT and CSE and UWS. Table A.7 shows Autumn 2007 salary data for the computer science-related programs at UWB, UWS and UWT as reported by the UW Office of Institutional Studies.

Table A.7: Computer Science Faculty Salary Comparison for University of Washington for Autumn 2007

		9/10 Month Service Period Group				**New Hires**	
		Low	**High**	**Average**	**Total FTE**	**Avg**	**FTEs**
Professor	**CSS**	**114,660**	**123,174**	**118,917**	**1.7**		**0**
	TCSS	114,012	123,228	119,159	6.0		0
	CSE	102,366	179,667	133,186	17.7		0
Associate Professor	**CSS**	**90,702**	**102,321**	**97,731**	**5.0**		**0**
	TCSS	105,561	105,561	105,561	1.0		0
	CSE	101,403	112,140	107,486	9.0		0
Assistant Professor	**CSS**	**--**	**--**	**--**	**0.0**		**0**
	TCSS	88,524	91,872	90,603	4.0		0
	CSE	86,004	91,881	88,358	6.0	86,004	1
Lecturer	**CSS**	**71,937**	**72,558**	**72,248**	**2.0**		**0**
	TCSS	68,382	70,209	69,296	2.0		0
	CSE	75,132	98,064	88,704	4.0		0
		11/12 Month Service Period Group				**New Hires**	
Associate Professor	TCSS	134,664	134,664	134,664	1.0		0
Lecturer	CSE	74,934	82,320	78,627	2.0		0

Of most concern from the faculty stability perspective is that the average salary of the associate professors at UWB is 7-7.5% below that of their colleagues at UWT and UWS. This rank is populated with mid career, very productive, and successful faculty. Retention of them will become increasingly difficult as they not only fall further behind the industrial marketplace but increasingly find their salaries not even competitive with those of their UW peers.

As an example, our most junior associate professor, while having recently enjoyed a promotion and accompanying pay raise, finds himself with a salary fully 12% below the next lowest associate professor in computer science *in the entire university*. In fact, this person's salary as associate professor is only 5.2% above that reported for the only assistant professor hired by the University this year. Besides endangering retention of mid-career faculty, this situation will make it difficult as well to hire new assistant professors in the future.

The situation at the lecturer rank looks better in Table A.7 than it really is. In fact, both of our "Lecturers" in this table are Senior Lecturers holding Ph.D.'s and with many years experience in the CSS program. Both are actively publishing in the educational and/or research literature. One had decades of experience in the industrial sector before joining CSS in 2000. The other was a founding faculty member of CSS in 1996 and she has won the UW Distinguished Teaching Award. If the salary table had a category for Senior Lecturers of comparable experience and distinction, we are confident that once again CSS salaries would be seen to be lagging well behind those of our UW peers.

As a final comment on faculty salaries, we note that like most departments we have an on-going critical need for a few very capable part-time lecturers. The percentage of courses taught by part-time faculty ranges from 15-30%, depending on the number of full-time faculty on sabbatical leave, receiving research course relief through grant funding, or experiencing course relief for administrative service. The majority of all CSS courses taught by part-time faculty are taught by two long-term lecturers (Anderson and Kochanski) who have each been with the program for many years. Our ability to retain these long-serving part-time faculty and attract others on a less frequent basis is impaired because our institutional salary structure provides approximately $6K for each five credit course taught by temporary appointment. The program can exceed that amount if necessary, if it can find funding, but the "nominal" $6K/course remains the campus norm. In our experience, this is well behind the pay for part-time lecturers at the Seattle campus. When we hire a lecturer who also teaches at CSE or the Information School at UWS, we often have to pay $7-9K/course, leaving us at a distinct disadvantage in bidding for their services. Just as with the full-time faculty, it is imperative that our part-time faculty receive pay comparable to that of their peers on the Seattle campus.

3. Insufficient Number of Faculty

Looking beyond the challenges of serving the full breadth of computer-related courses needed for a high quality education, the small number of faculty in CSS prevents us from providing the full range of sections needed by our students at the times when they desire them. In an attempt to provide access to working students, we presently admit new transfer students in autumn and spring term and attempt to maintain a program in the evening as well as during the day. Since our faculty has become fewer, the offerings in the evening time slots have become less frequent, and it is becoming more difficult for part-time working students to achieve an education in an efficient manner. We maintain a strong set of offerings at the early evening time slot 5:45–7:50 PM, but are now offering only four courses (out of more than 60) this year at the 8-10 PM slot. The evening program is still feasible for a part-time student, but it requires very careful planning and almost no unexpected developments on the part of the students. If we had adequate faculty, we would repopulate the evening program with a full set of courses and would admit students in the Winter term, giving more flexible access to our program by providing the needed “start-up” courses every term.

CSS has eagerly supported and participated in the expansion of UWB to the lower division within the last two years. With no additional faculty, the program has begun to offer six sections of introductory programming courses and information fluency courses to majors and non-majors alike. The program faculty has committed itself to be full players in the integrated interdisciplinary core curriculum (Discovery Core) required of all freshmen by teaching three sections a year. However, without additional faculty, that level of commitment is almost the complete extent of what we can provide at the lower division. In particular, we are offering only one 200-level sophomore course this year, even though the CSS program has the desire and curriculum available to offer 2-3 more. These courses not being offered include general courses in computers and society, mathematics, and computer-related science courses that our students should have available for a well rounded education. But, these courses cannot be offered with such a small faculty stretched so thin.

One of the most striking consequences of CSS being so lightly staffed is what is missing. The much in-demand MSCSS program, approved over five years ago, remains on the shelf and unavailable because the program lacks the faculty resources needed to launch it. This represents a lost strategic opportunity to serve the community better and to prepare for the next high technology cycle by investing in the CSS faculty in a timely manner.

4. Staffing Limitations

Just as the faculty have stretched to new responsibilities, so have the support staff of CSS. The same three staff members of four years ago now have added to their responsibilities: external recruitment of new students in community colleges and high schools, career counseling, and advising of all prospective CSS majors from the lower division population. Many of these tasks are handled in a general way by the central Student Affairs staff of UWB. But, the CSS director has found that to be effective in the highly specialized technology/engineering arena, it is also important to have specialized staff involved in very tightly focused activities. One example is that the CSS program staff spend time recruiting by visiting the computer science programming classes at some of our feeder institutions. This type of access, which is a very effective recruitment activity, is simply not available to general campus-wide recruiting staff.

A consequence of the director assigning these many unfunded but necessary activities to his staff is that there is less staff time available for in-office advising sessions and administrative support work. This has been manageable thus far during a period of somewhat reduced enrollment, but will become a clear weakness as the number of students increases during the present cyclic upturn and as larger numbers of lower division CSS majors move into our system. Because we lack a plan for staff growth during the coming cycle, we will have to choose at some point among the various services that the students need and expect.

5. Section Summary

Overall, the main weaknesses of the CSS program are its limited ability to serve part-time evening students, its limited ability to serve the growing lower division population at UWB, and the lack of ability to serve the significant community demand for the MSCSS degree. It is difficult to compare programs with somewhat different circumstances, but we note that the in-many-ways similar CSS program at UWT is staffed by at least 20% more faculty and at least twice as many support staff. It is in our view, a fundamental and structural weakness not to invest strategically in the program during this time of lower enrollment. The costs of entirely missed opportunities (such as the MS degree) are real, but not always obvious. The costs of maintaining the staffing level at the status quo will become very obvious during the expected upcoming enrollment growth.

4. Changes That Have Affected Our Role

The fields of computer science and software engineering are evolving very rapidly, while at the same time higher education is undergoing profound transformation. Being a new program, our responses to these changes have in many ways been in the form of initial design characteristics and implementation rather than radical changes of direction. One of the industrial transformations in recent years has been a shifting of positions in the software and information technology sectors to higher level ones demanding more ability to coordinate and integrate well in software design and implementation. This has occurred as some more fundamental routine tasks have been outsourced to contract software houses, sometimes off-shore. The CSS program was conceived at a time that this change was apparent and, from the start, has incorporated significant aspects of software engineering and IT management principles in its curriculum. Another trend evident in Washington and elsewhere has been an increasing importance of technology sector jobs in areas of specific application, such as bioinformatics or health care informatics. As an indicator, the 2007 Washington State Labor Market and Economic Report[2] showing annual growth in computer related jobs of approximately 2.8%, a category that includes positions in specific application areas. CSS has responded to this change in direction with both the career transition pathway in our MS degree program and to the new BAAC.

Among other national trends is the greater involvement of undergraduates in experiential learning at some significant level. The cooperative education requirement and involvement in undergraduate research have, between them, been part of the education of every single CSS student. Approximately 10-15% of the students carry out undergraduate research working in the laboratory under the guidance of a CSS faculty member studying some problem at the frontier of new knowledge. Approximately 85% of the CSS graduates have been engaged in a capstone project in an industrial, governmental, or nonprofit setting. In every case, the students have had the opportunity to apply their education to real world, important problems, while working closely with professionals in the field.

As the nature of the student body has changed to include many more working students, CSS has been part of the general movement to experiment with alternative education delivery models. As part of a consortium funded by the Department of Labor, CSS faculty developed course materials and gained experience offering several courses from our BS curriculum via distance learning methodology. Excellent material was generated at all curricular levels. Student interest in lower division programming courses was high during the initial period of subsidy by the Department of Labor. However, the timing was such that the high technology software economy began to deteriorate just as these students would have begun taking the upper division curriculum to major in CSS. The resulting diminution in workforce demand coupled with an end of Federal subsidy

[2] Washington State Employment Security Dept, http://govdocs.evergreen.edu/wastate/wslmia/almer/2007annrept.pdf

for the students caused interest to dwindle. Less than five students worked along to the upper division level, and they transferred to the ordinary CSS program.

In recent years, undergraduate students have increasingly participated in a foreign study experience in their undergraduate education. In Table A.8, it is seen that the number of students at UW studying abroad has nearly tripled in ten years. While CSS students have all of the ordinary study abroad options of the UW available to them, CSS itself has strived to provide an opportunity particularly well suited to our advanced students through collaboration with the Computer Science Department at Ehime University of Japan. Through this program, three students from UWB have gone to Ehime and three Japanese students have come to study at UWB. In most of these cases, the students are engaged in individual research projects with faculty at their host institution.

Table A.8: Number of UW Students studying abroad by school year

School year	Number of Students
1997-98	702
1998-99	763
1999-00	859
2000-01	1008
2001-02	1118
2002-03	1294
2003-04	1470
2004-05	1621
2005-06	1747
2006-07	1962*
*estimate	

5. University Expectations

The expectations of the greater university and campus are not always clearly aligned with the reality experienced by the CSS program. UWB is a new campus, and CSS is the only STEM program or department on campus. As a rapidly growing campus in a region that values greatly education in technological and scientific areas, there is considerable pressure on UWB to be innovative, expansive, agile, and positioned to serve tomorrow's students and needs. The institution and region have sent clear signals that new programs and modes of operation would be welcome, especially in the STEM fields.[3] The CSS program is expected to be a creative and vital player in the evolution of UWB to a state of success in STEM education and in serving the technology needs of the community. On the other hand, the CSS program, like all programs at UWB, has been funded by a very conservative, metric-driven algorithm that provides no new resources at all during a period of stagnant enrollment. The consequence is that while funded in a

[3] *State and Regional Needs Assessment*, Washington Higher Education Coordinating Board, October 2005.

way that permits almost no risky expansion into new innovative areas of strategic importance, the program is expected to provide leadership in developing the scientific, mathematical, and engineering facets of UWB. The expectations for innovation are inconsistent with a conservative funding model best suited for support of the status quo during periods of solid constant enrollment. We are encouraged, however, by a recent administrative decision to abandon this metric-driven model during the upcoming biennial budget cycle.

The university community fully expects CSS to succeed as the only STEM related program at UWB. This expectation does not seem informed by the fact that science and engineering programs generally function in broad comprehensive environments rather than very narrow, single-department niches. While we have not done a systematic survey, we are unaware of any precedent for long term success of similarly isolated science departments.

The general expectation of the UWB community has been for each academic program to be involved in master's level education as well as that of baccalaureate students. In fact, as shown in Table A.9, all programs except CSS have thriving master's degrees.

Table A.9: Autumn 2007 Enrollment

Gradate Programs	FTE Target	Actual FTE	% FTE Target met
Business	75	96.6	129%
Education	38	44.1	116%
IAS	43	31.6	73%
Nursing/Health	20	27.7	139%
Total # of Graduates	176	200	114%

Due largely to the UWB conservative funding model, CSS remains in effect an undergraduate-only program, with the obvious implication for program prestige and faculty morale. The faculty find themselves frustrated in that their roles as graduate faculty and mentors remain completely unfulfilled after 11 years. Students even ask why CSS is the only program on campus without a graduate degree and why it is the only computer science related program in the entire UW system without one. Clearly, the general expectations of the UW, UWB, and the students are out of alignment with the long-term reality within the program.

6. Faculty Governance

The CSS faculty, although quite small with only nine voting members, operates in full compliance with the UW Faculty Handbook. There is a well defined committee structure within CSS, with the memberships appointed by the director. Committee assignments and roles as chair are distributed evenly over the entire faculty, and assignments rotate frequently so that all members gain a broad range of experience. At present, most faculty serve on 2-3 committees and are responsible for chairing one. The present committees include Academic Appeals, Admissions, Curriculum, Infrastructure, Personnel, Merit Review, Speaker Series, and Strategic Initiatives, and the memberships can be found in Appendix D. The only committees with executive authority to act on behalf of the rest of the faculty are the Academic Appeals, Admissions, and Merit Review committees, which report their recommendations for action directly to the director. All other committees report on study questions and make recommendations for action to the entire faculty. All tenure track and other full-time faculty vote on all matters before the program. Usually one retreat per year is held off campus to allow for development of strategic initiatives and to receive the annual "state of the program" report from the director.

The budget of the program is made completely available to the entire faculty and staff at the annual retreat. (See budget or program resources discussion in next section.) Strategic planning is generally started at the retreat, developed more thoroughly by the Strategic Initiatives Committee, and ultimately modified and approved by the faculty as a whole.

7. Program Resources

In Appendix B is found a budget and expense summary for CSS program in the 2006-07 fiscal year. The year 2006-07 was chosen as being reasonably typical and the most recent one that is complete. The numbers would, of course, vary from one year to another. The state budget is on a biennial basis, so income from state funds is estimated for 2006-07 fiscal year as being approximately one-half of the biennial budgeted amount. Expenses are for the actual year. The carry-forward budget (see discussion that follows) can only be considered on a biennial basis.

Income

As is typical of a young department, the Table 1 in Appendix B shows that a majority of our resources (87%) come from the state instructional budget. The second largest source of income is from external research grants (10%) that fund specific efforts in the research laboratories of individual faculty PI's. The CSS program also receives a small, but important, income from the UWB indirect cost recapture formula, course fees to maintain student drop-in laboratories, and discretionary gifts and endowment income. Since 95% of the state budget is for salaries (Table 2), only $55K of it is available to the director to fund travel, operations, supplies, and equipment. The amount reported for "income" is actually the balance of the biennium remaining at the start of the fiscal year, approximately one-half of the biennial total.

Expenses

Annual expenses are also dominated by state funds, which in turn are dominated by salary expenditures (Tables 3 and 4 of Appendix B). Due to partial funding of some salaries from research grants, the amount spent from the state budget for Tenure/Tenure Track faculty is less than allotted. But, this is more than balanced by salaries devoted to part-time lecturers to replace and supplement the full-time faculty. The overall picture is that the program spends somewhat more ($26K in this year) than allocated by the state on faculty salaries and considerably more than is allocated for professional travel, and computer equipment to support scholarly and instructional activity. To compensate and keep the annual expenditures roughly in balance with income, the program spends correspondingly less than is allocated on hourly workers and miscellaneous contract services. This represents an intentional emphasis of the program administration on instruction, faculty research, and professional development of faculty and staff.

The total income and expenses (Tables 1 and 3 of Appendix B) are very close to being balanced. This is somewhat accidental, as there is no *a priori* reason why the amount of new RCR monies not spent during the year spent on research support (but still income) should approximately balance the state budget overrun.

Year-end Non-State Balances

While most instructional needs are funded by the state budget, the non-state funds shown in Table 5 represent money that can largely be spent by the director to support any of the program activities. The total of these funds increased by $15.5K during the 2006-07 year, mostly due to RCR (indirect cost) funds that were not completely spent. Regarding the RCR balance, the CSS program policy has been to allocate one-half of all RCR funds returned to the program for the support of the laboratory/research efforts of the faculty member who received the grant and apply the other half to supporting the general research infrastructure of the program. Approximately 20% of the accumulated RCR Balance is money being reserved for the research needs of individual PI's. Since the campus does not have a clear policy for providing start-up funding for new faculty, the program administration has conservatively assumed that, like more established campuses, the central administration will look to the program to provide some part (perhaps one-third) of new faculty start-up packages. Anticipating growth of the CSS faculty over the next few years, as the campus' STEM focus grows and the MSCSS is hopefully launched, the majority of the accumulated RCR funds (approx $65K) is being reserved for that purpose.

Biennial Carry-Forward

The Table 6 displays the biennial "carry forward" balance at the start and end of the 2005-07 biennium. The UWB administration has demonstrated flexibility in allowing state budget residues at the end of a biennium to be carried over to the following one, if they are to be used for program and campus priorities. This replaces the more traditional end-of-biennium "spend down" by each unit, which would sometimes result in less prudent expenditures. The CSS administration policy is to contain basic operational and instructional expenses within the state budget, with only a small surplus or deficit accumulating as carry-forward funds each biennium. As shown in Table 6, the carry forward amount increased by $3.8K over the two year period during which the total state budget was approximately $2,100K a net residue of less than 0.2%. This accumulated money is treated as an "emergency" fund to be spent to address unanticipated (and unbudgeted) instructional expenses that may arise.

8. Mentoring

Since the program has no assistant professors and has not hired since 2001, the faculty mentoring is now primarily aimed at mid-career associate professors. The program has only two full professors to accomplish this mentoring, one of which is the director. The duties are shared by these two senior faculty. Professor Cioch chairs the annual senior merit review committee that not only reviews the cases of the associate professors for annual merit consideration, but also reflects annually on the progress of each toward promotion to full rank. That senior committee, comprised of Professor Cioch and at least two external full-rank members of the UWB faculty, give feedback on progress thus far and provide explicit suggestions to the faculty for achieving promotion. The director delivers this assessment to each associate professor after commenting on it himself. The faculty are then invited to meet with Professor Cioch and the director to discuss the assessment they have received. In determining their biennial goals and objectives, the associate professors meet with the director and discuss their progress toward promotion.

To further the opportunities for professional advancement, the associate professors are strongly encouraged to apply for regular sabbatical leaves, are offered program support for exploratory visits to funding agencies, and are encouraged to fund instructional "buy outs" through the various research funds available to them.

As a new and growing institution, UWB places a very heavy burden of institution building upon its mid-career faculty. Faculty are encouraged to serve in very time consuming and important roles at the stage in their career when they would normally be devoting energy to activities that would result in eventual promotion to full rank. Thus, while the senior faculty may mentor the hard working and capable people about the types of activity that will result in their professional development, the institution continually implores them to devote time to equally important activities that will do much less to facilitate their eventual promotion. This is a very serious weakness throughout the UWB culture that needs to be addressed in some way. It is noted that the only two full professors in CSS achieved their initial promotion to that rank either elsewhere (Jackels) or shortly after transferring to UWB (Cioch), having accomplished the bulk of his mid-career work at a previous institution.

No graduate students need mentoring at present.

Undergraduate mentoring is achieved formally and primarily through the academic support staff within the program. Before enrolling in their initial quarter, every student is required to receive a one-hour individual orientation session from one of our two counseling services coordinators. These advisors continue to stay in touch with students on a regular basis via e-mail and by in-person conferences. The academic progress of the students is monitored closely, and when a student seems to be making unsatisfactory progress, they are called in for proactive counseling. As the student approaches their senior year (half way through the typical UWB CSS experience), they are required to meet with their academic advisor to file their graduation petition and with the programs cooperative education coordinator to discuss their capstone project plans. The latter generally involves one or two follow-up conferences with the coordinator.

Individual faculty mentoring is common because the classes are small, TA's are virtually nonexistent, and the faculty gets to know each student in their classes. In addition, the capstone project of each student must have a faculty mentor or 2nd reader, in addition to the undergraduate research advisor or external industry sponsor. The students know from the beginning that they will eventually need to approach faculty about this important responsibility and, therefore, endeavor to get to know them.

In addition to these opportunities, the CSS staff has established a Peer Mentoring program, in which senior CSS students assume mentoring responsibility for incoming students who desire this relationship. Peer mentoring provides a network of encouragement and collaboration between CSS students. Students who serve as mentors are mature seniors, post baccalaureate students, or CSS alumni who can offer guidance and support to new students making their way through their first year of studies in CSS. The mentoring program offers a supportive academic and social climate for both the mentor and the mentee, generating an atmosphere of cooperation within CSS.

While the requests for peer mentors are not numerous, the students who do utilize this service benefit enormously from it. Between Spring 2004-Winter 2007, there have been 24 mentors and 22 mentees participating in the CSS Peer Mentoring Program.

SECTION B – TEACHING

1. Unit Balance

A core curriculum of eight fundamental courses is required of all BS majors, and those courses tend to have reasonably large enrollments of 25-45 students each. Sufficient electives must be offered to allow students by their choice to emphasize different aspects of the curriculum, such as advanced computer science, project management and planning, or information technology. To provide this breadth in specialization areas, which are a hallmark of the program, it requires us to offer some lightly enrolled elective courses, with enrollments less than 20 students.

Depending on the balance of core/elective courses in a faculty member's assignments, teaching loads may vary considerably from year to year in terms of the number of student credit hours per class taught. Virtually all classroom courses within the CSS curriculum are five-credit quarter courses. An attempt is made through the scheduling process to achieve rough parity among the full-time faculty in the number of student credit hours. Typically, a faculty member with a high student per class loading in one year will receive a balancing (lower) load the following year. In addition to the average number of students per class, the number of classes assigned varies between faculty and from year to year. This variation is intentional and is explained here (Section B.1) and in Section B.2. We do note that at the UWB campus level, the number of courses taught by any faculty is irrelevant, as the staffing metric is based on the number of student credit hours delivered, rather than on the number of courses delivered.

The teaching loads within CSS are meant to be balanced in the sense that each faculty member will over time have approximately the *same average student credit hours per section*. Intentional variations in teaching loads, such as arises from purposeful course releases would affect the number of sections taught, but not the average number of students in each. Since CSS has a mixture of more heavily enrolled core courses and less heavily enrolled electives, this design principle assures that each faculty member, regardless of their course release situations, will be teaching at both the core and elective levels. Table B.1 presents the actual teaching load for each faculty member during the 2004-05 academic year (a typical one) and the average loads for the last five years. The faculty entries have been ordered in terms of the average number of student credit hours per section (St Cr Hrs/sec), since that is the metric used to achieve a balance over time.

Table B.1: Teaching Load Average for Typical & Average years

	Typical Year (2004-05)		Average of Last Five Years	
Faculty	Courses	St Cr Hrs/sec	Courses	St Cr Hrs/sec
F1	6	126	5.8	99
F2	1	90	3.2	104
F3	5	105	4.6	130
F4	4	124	4	128
F5	1	75	1.7	92
F7	5	98	3.5	98

Faculty	Typical Year (2004-05)		Average of Last Five Years	
	Courses	St Cr Hrs/sec	Courses	St Cr Hrs/sec
F8	5	147	4.4	126
F9	*	*	4.5	78
F10	5	129	4.2	88
F11	6	121	6.4	105
Average Across Faculty				107.1
* On sabbatical				

The five-year average across all faculty is approximately 107 student credit hours/ section, or an average enrollment of 21.4 students in a five credit course. The deviation among the faculty is at most about 25% above or below the average.

While the data in Table B.1 shows that the teaching loads are reasonably well balanced within CSS, it is interesting to compare the loads (as credit hours/section) to those within our sibling departments: Computer Science and Engineering at UWS (CSE) and CSS at UWT (TCSS). Because the circumstances at UWB (and UWT) do not lend themselves yet to the delivery of large lecture sections of introductory service courses, the most appropriate comparison is between the upper division classes offered by CSE and those of the two CSS programs. From Table B.2, it can be seen that for the 2006-07 academic year, the CSS teaching load *per section* is comparable to the others, being about 20% larger than that at CSS at UWT and 20% smaller than at CSE.

Table B.2: Credit Hours per Section - 2006-07 Comparison

UW Program	# of Instructors	Average Student credit hours
CSS	10	95
CSE*	115	115
TCSS	14	79
* upper division only		

2. Teaching Responsibilities

Teaching responsibilities within CSS are determined by the director. After consulting with each individual, the director makes the final assignments and distributes that to the entire faculty. Annually at the “state of the program” report, the director reports to the faculty on distribution of teaching responsibility among the faculty during the previous academic year. The academic schedule for the entire following year is distributed in nearly-final form during March of each year. While subject to change as needed, the faculty have their annual schedule in hand and can plan accordingly nearly six months before the start of the academic year.

Each tenure track faculty member in CSS is nominally assigned five regular five-credit classroom courses and responsibility for mentoring their share of the CSS 497 cooperative education students. Each full-time senior lecturer is assigned six such five-credit courses as well as CSS 497 responsibility. These CSS 497 credits do not figure into the routine formula for assignment of teaching loads and can be considered “extra duty” beyond the five or six course teaching load typical at UWB. The teaching responsibility for CSS 497, representing 10-15% of the overall CSS credit hours, is distributed among faculty as dictated by student mentor selection. The assumption here is that over time, the CSS 497 students will tend to distribute themselves evenly enough to avoid overburdening any individual faculty. This is an important matter, since the work of mentoring a CSS 497 student can be considerable. Also, by not explicitly assigning CSS 497 as a “taught course,” it makes the program teaching load appear to be less than it actually is – always a concern in comparison to other UWB programs, where undergraduate research and cooperative education are much less common.

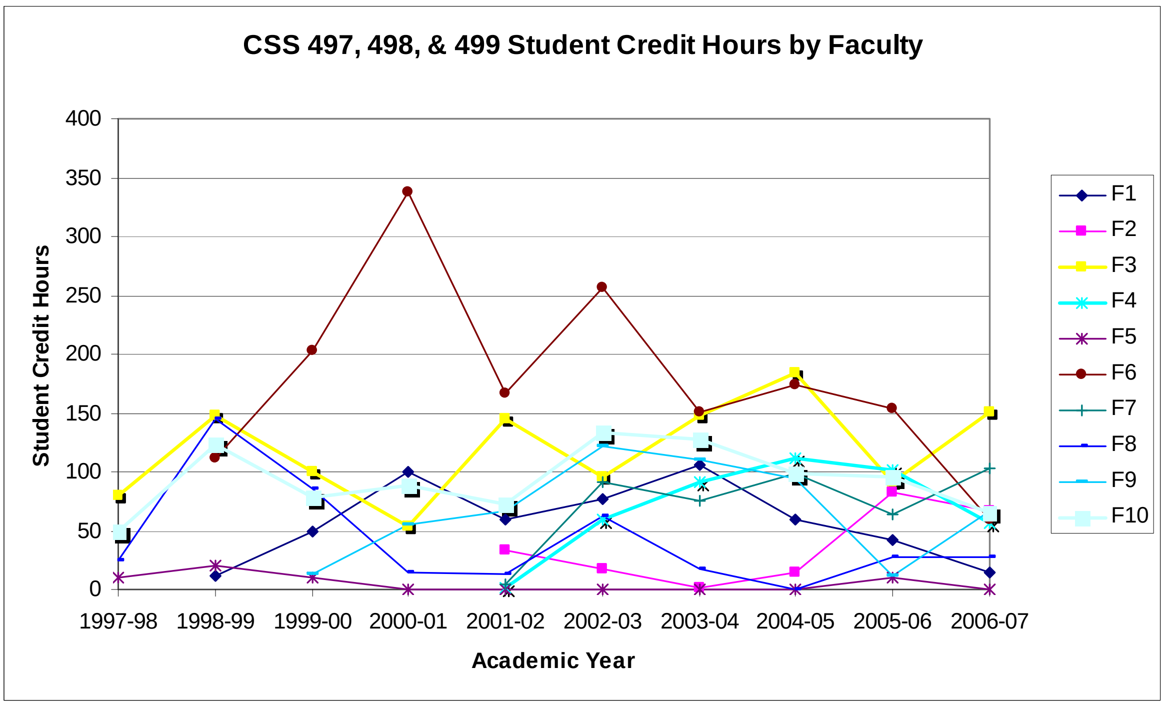
In Table B.3 it can be seen from the longitudinal data that the program faculty mentor an average of approximately 133 Cooperative Education (CSS 497) and independent study projects (CSS 498) per year, or nearly 13 per faculty member.

Table B.3 Total CSS 497/498 Projects by School Year

	2002-03	2003-04	2004-05	2005-06	2006-07
497 Projects	121	98	98	79	75
498 Projects	28	24	29	22	16
Total Projects	170	141	142	116	99

To examine the distribution of these “extra” credits among faculty, data giving annual student credit hours (in cooperative education, independent study, and undergraduate research) taught by each faculty member is presented in Figure B.1, where the faculty tags “F#” do not refer to the same faculty as in Table B.1.

Figure B.1: Student Credit Hours by Faculty and Academic Year



The data in Figure B.1 shows a considerable variation between faculty for this responsibility. The most serious imbalance (faculty F6 in the early 2000's) has been addressed successfully through advising of the students during mentor selection. The remaining imbalances in this "extra" teaching responsibility are known to the CSS faculty and have been determined to be acceptable.

Faculty are encouraged to seek research funds to partially "buy out" some of their teaching time in order to enhance their scholarship. Unless special arrangements are made, each faculty is limited to two such research courses buy outs per academic year. The courses to be selected for relief and their scheduling are matters of negotiation between the director and faculty investigator. In addition, a small number of course releases are granted to faculty each year to allow them to assume unusual administrative, curricular development, or faculty government governance responsibilities. Table B.4 shows that the total number of course releases for either research or administrative reasons is typically no more than 5-10% of the total courses assigned.

Table B.4 Total Course Releases by Academic Year

	2002-03	2003-04	2004-05	2005-06	2006-07
Research Buyouts	1	2	2	2	2
Administrative Release	1	0	1	2	3
# of Courses Taught	59	51	47	54	52

All faculty are expected to teach a mix of lower division courses, required CSS core courses for majors and elective courses for majors. This mix is chosen to give individual faculty a range of responsibility as well as to balance the load between the more and less heavily subscribed courses. Every faculty has the opportunity to teach an elective course in their research area at least once per year. This offers an important way to attract students to their research projects.

CSS has the opportunity to benefit from three joint or adjunct faculty appointments in which faculty are shared with other UWB programs, as follows:

- Jackels (joint with IAS)
  Jackels has 2/3 of his appointment in CSS and 1/3 in IAS, with teaching loads made independently in that proportion by each program. As director, he has flexibility in working around those guidelines.
- Leong (adjunct with Business)
- Rasmussen (adjunct with IAS)

  In the cases of Leong and Rasmussen, both faculty are 100% in their primary units, and CSS arranges with the directors of their units to "buy" each person's resources for one course per year. The two programs negotiate an acceptable schedule, the host program provides a course release to accommodate the CSS course, and the CSS program reimburses the home program for the person's services. The first type of arrangement is sustainable, because each program "owns" part of Jackels teaching resources without any exchange of money. The latter two are less sustainable, since they depend upon CSS having adequate funds at hand to purchase the resources. There have been times when inadequate funding has precluded making these highly desirable cross-program appointments.

3. Student Academic Advising

Within CSS, the students formal academic advising is accomplished by a professional staff rather than the faculty themselves. However, because our classes are small and each student must carry out a capstone project under the individual mentorship of a faculty member, all of our students are well known by many of our faculty and have many opportunities to be mentored and supervised by them. In addition, some individual faculty serve in corresponding roles, such as faculty advisor of the student ACM organization.

4. Student Research

At least 75% of the CSS faculty have at one time or another mentored a student in an undergraduate research project. This is distinct from the more common mentoring of cooperative education capstone projects. The research students often carry out studies associated with funded research, and the projects frequently continue into the summer months. At least 17 of these student efforts have resulted in joint authorship of journal articles or conference presentations.

5. Student Assessment of Faculty

The CSS faculty take assessment of teaching very seriously. It is the program culture that every faculty member collects student assessment of teaching effectiveness for every course taught and turns a copy of that assessment into the director’s office. This goes well beyond the Handbook requirement of one assessment per year (Sec 24-57-A). In addition, these assessments are required components of the faculty member’s reports and dossier presented for annual merit raises and promotion consideration. The director reads each evaluation and the associated informal comments submitted by the students. If the evaluations reveal conditions or trends that should be addressed, this matter is brought up with the faculty involved. Table B.5 presents the program averages of the four general questions used in each form of the standard evaluations and the six questions addressing the level of student engagement. These scores are seen to be quite stable over five years, with the overview question medians approximately 4 (out of 5) and the “challenge/engagement” questions (24-27) being 5.3-5.4 (out of 7).

Table B.5: CSS Yearly Evaluations (median) Autumn 2002 – Summer 2007

Evaluation Question	02-03	03-04	04-05	05-06	06-07
1. The course as a whole was:	3.9	4	4	3.9	3.8
2. The course content was:	3.8	3.9	4	3.9	3.8
3. The instructor's contribution to the course was:	4	4.2	4.2	4.1	4
4. The instructor's effectiveness in teaching subject matter was:	3.8	4	4	3.9	3.9
COMBINED ITEMS 1-4	3.9	4	4	3.9	3.9
Relative to other college courses you have taken:					
23. Do you expect your grade in this course to be:	4.5	4.5	4.5	4.5	4.4

Evaluation Question	02-03	03-04	04-05	05-06	06-07
24. the intellectual challenge presented was:	5.4	5.4	5.3	5.3	5.3
25. The amount of effort you put into this course was:	5.4	5.4	5.4	5.3	5.2
26. The amount of effort to succeed in this course was:	5.5	5.4	5.4	5.4	5.3
27. Your involvement in course was:	5.5	5.4	5.4	5.4	5.1
28. On average how many hours have you spent on this course:	2.35	2.23	2.25	2.19	2.09
29. From the total avg hrs spent, how many do you consider were valuable in advancing your education?	1.81	1.72	1.84	1.73	1.59
30. What grade do you expect in this course?	3.3	3.3	3.3	3.2	3.3
Average number of respondents	1029	947	745	599	621

To compare the student evaluation scores in CSS to other science/engineering departments at the UW, we present Table B.6 for the 2006-07 academic year by quarter the 100,200, and 300 level courses in CSS and the College of Engineering (COE). Where there is a significant difference between the CSS and COE scores, it usually represents a quarter-to-quarter variation of the CSS scores, which are more volatile due to the approximately 30-fold smaller number of respondents.

Table B.6: Student Evaluation Results (median) by Academic Year comparing the College of Engineering (COE) with Computing and Software Systems (CSS)

Student Evaluations	Autumn 2006		Winter 2007		Spring 2007	
	COE*	CSS**	COE*	CSS**	COE*	CSS**
1. The course as a whole was:	3.8	3.6	3.7	3.7	3.8	3.9
2. The course content was:	3.8	3.6	3.7	3.7	3.8	3.8
3. The instructor's contribution to the course was:	4.0	3.7	4.0	4.0	4.1	4.2
4. The instructor's effectiveness in teaching subject matter was:	3.9	3.3	3.9	3.9	4.0	4.0
COMBINED ITEMS 1-4	3.9	3.6	3.8	3.8	3.9	4.0
Relative to other college courses you have taken:						
23. Do you expect your grade in this course to be:	4.6	4.3	4.6	4.2	4.6	5.0
24. the intellectual challenge presented was:	5.1	4.8	5.1	5.0	5.0	5.1
25. The amount of effort you put into this course was:	5.1	4.9	5.1	4.9	5.0	5.4
26. The amount of effort to succeed in this course was:	5.2	5.1	5.2	5.3	5.1	5.5
27. Your involvement in course was:	5.2	4.9	5.1	5.0	5.1	5.3
28. On average how many hours have you spent on this course:	2.23	1.95	2.28	2.21	2.24	1.95
29. From the total avg hrs spent, how many do you consider were valuable in advancing your education?	1.68	1.35	1.70	1.61	1.67	1.44

Student Evaluations	Autumn 2006		Winter 2007		Spring 2007	
	COE*	**CSS****	**COE***	**CSS****	**COE***	**CSS****
30. What grade do you expect in this course?	3.4	3.3	3.4	3.2	3.4	3.3
Average number of respondents	3483.4	118.083	3387.4	88.7	3061.4	71.3
*College of Engineering 100, 200, 300 Level Courses						
** Computing & Software Systems 100, 200, 300 Level Courses						

In addition to the student assessment of teaching effectiveness, the faculty carry out formative peer reviews of their teaching on a schedule consistent with the Handbook requirements: every three years for full and associate professors and annually for others. These collegial evaluations include classroom visitation, syllabus review, and general discussion of appropriate pedagogy.

Extra care is taken both to assess and mentor new faculty and those with casual appointments. In those cases, the director makes it a point to discuss the course with the less experienced instructor and personally visit the classroom. Also, in those cases, the results of student evaluations become part of the dialogue involved in any subsequent reappointment.

6. Data Collection on Student Learning

All faculty are reminded about the availability of CIDR (UWS) and the Teaching and Learning Center (UWB) to assist in assessing their teaching and in formulating effective strategies for improvement. While faculty are not required to inform the program office about their use of such confidential services, a number of them have done so. It is known that at least four CSS faculty have employed the services of CIDR or TLC for this purpose.

7. Mentoring Faculty

The director works very closely with new faculty to mentor them in their teaching. The program is small and has few enough junior faculty so the director can accomplish this personally. Care is taken to develop their range of teaching responsibilities gradually, without an unduly large number of new courses in the first year or two. The teaching “repertoire” of the new faculty is built up gradually, one course at a time, with repeats of those courses usually before they are asked to assume new responsibilities. The goal is to achieve significant breadth in their teaching (an introductory course, one at the intermediate level from the core, and one or two upper level electives) within the first 2-3 years. Over the next two years, faculty have typically added another intro course and another intermediate level course.

This gradual building up of teaching responsibilities combined with frequent feedback from students and colleagues and use of the teaching resources at UWB have resulted in the development of very successful young teachers in CSS. As one point of evidence, the average assessment scores for our two most junior and least experienced faculty (both recently tenured) for a recent two-year period shows that they are quite well received by the students and are receiving assessments equal to or greater than the program averages. (See Table B.7.)

Table B.7: Two Newest CSS Professors Evaluations (Median), Aut 2005-Sum 2007

Evaluation Question	**Median**
1. The course as a whole was:	4.1
2. The course content was:	4.1
3. The instructor's contribution to the course was:	4.3
4. The instructor's effectiveness in teaching subject matter was:	4.1
COMBINED ITEMS 1-4	4.1
Relative to other college courses you have taken:	
23. Do you expect your grade in this course to be:	4.7
24. the intellectual challenge presented was:	5.6
25. The amount of effort you put into this course was:	5.5
26. The amount of effort to succeed in this course was:	5.5
27. Your involvement in course was:	5.4
28. On average how many hours have you spent on this course:	2.33
29. From the total avg hrs spent, how many do you consider were valuable in advancing your education?	1.82
30. What grade do you expect in this course?	3.4
Average number of respondents	228

All faculty, especially new ones, are encouraged to attend the Provost workshops on teaching offered each September, in which master UW teachers lead workshops on various techniques that are known to work.

The faculty are encouraged to attend conferences with significant pedagogical content in order to remain at the cutting edge of computer science teaching theory and practice. The program, funds these trips on the same basis as trips to basic research conferences. In recent years, faculty have attended numerous national (SIGCSE) and regional (CCSC-NW) conferences with strong focus on CS education, as well as the Council on Undergraduate Research (CUR) national meetings. We invite our faculty who are leaders in CS pedagogy, such Professor Zander, as well as visitors from other departments, to give occasional seminars that inform us of the newest developments in that field.

One effective way to foster an interest in CS education and teaching is to show that it has been taken seriously by other faculty within the program. In that regard, the program is fortunate to have the following: a Distinguished Teaching Award winner; authors of two textbooks; two full-time faculty whose principal scholarship in recent years has been in CS pedagogy or text book writing; and at least three faculty who have received federal funding in recent years for projects related to teaching, learning, and developing the “educational pipeline.”

We do not use graduate TA’s and have none to be trained or mentored.

SECTION C – RESEARCH AND PRODUCTIVITY

1. Unit Practice

The foundation documents of the UWB campus and CSS program encourage and support a scholarship that is broadly defined and not limited to the traditional disciplinary and fundamental areas.

The UWB mission statement includes among its elements the following:

- Actively recruit and support outstanding faculty scholars with a passion for communication.
- Encourage and support collaborative, interdisciplinary, and cross-program initiatives.
- Attract and support an internationally diverse student body and a nationally recognized faculty and staff.

The UWB vision statement includes the following reference to the scholarship of the campus:

> "We will be noted for discipline-bridging scholarship, valued in the community, and respected in the academy."

"Engaged Scholarship" is listed and defined within the UWB core values statement:

> "As scholars and learners, we embrace scholarship that is innovative and rigorous. We encourage intellectual contributions that transcend the boundaries of conventional disciplines and enhance the education of our students.
>
> Our scholarship contributes to our region's dynamic economy and enhances the lives of its people. Awareness of and involvement in our community keeps us open, responsive, and responsible."

The mission statement of the CSS program includes the following:

> "The Computing and Software Systems Program seeks to accomplish this [provide a culture that fosters in faculty and students…] in undergraduate and graduate education through innovative interdisciplinary curricula, in scholarship and research that are both applied and fundamental, and in service to the UWB and external communities."

The mission statement goes on to say that the CSS faculty strives to:

> "Support and encourage, in ways deeply respectful of a broad range of interdisciplinary scholarship, independent and collaborative investigations of a fundamental, applied, or pedagogical nature."

The overall theme is that a broad range of scholarship, including that which is fundamental, applied, or pedagogical, is valued, encouraged, and supported within CSS and UWB. It is expected that the scholarship will be disseminated such that it is "recognized in the community" and that the faculty become "nationally recognized."

The CSS program expects its faculty scholars to do high quality research that achieves recognition within the scholarly community via dissemination through peer-reviewed means. The CSS faculty have a very broad range of scholarly interests, both within and beyond the traditional areas of computer science and software engineering. This breadth is viewed as appropriate and healthy at UWB and is in full alignment with the institutional mission and values.

Regarding promotion and tenure, decisions are made in accord with the UW Handbook. Promotion and tenure recommendations begin with review by a faculty panel, followed by a recommendation on the part of the program faculty, and proceeds to the Vice Chancellor accompanied by the recommendation of the director. Because of the small size and considerable breadth of the CSS faculty, in some cases, the director must appoint a review committee member from either UWS or UWT who has strong expertise in the candidate's area of scholarship. In the case of promotion to full professor, the review committee needs to be staffed in the majority by members outside of CSS because there are insufficient (< 3) full professors within CSS to accomplish the review. The latter is viewed as a temporary measure that will no longer be needed as the program matures in faculty rank.

The annual merit review, in accord with the UW Handbook, begins with an assessment of merit by CSS faculty members senior to the person being reviewed. Because CSS has only a single full professor in addition to the director, an ad hoc merit review panel with some non-CSS membership is generally appointed for consideration of the associate and full professors. The merit recommendations of the review panel are passed on to the VCAA with the directorial recommendations attached. In accord with the Handbook, the faculty are given an opportunity to meet with the chair of the review committee and director to discuss their annual merit recommendations.

CSS enjoys the benefits of adjunct appointment of two (at present) faculty who have full-time appointments in other units. In the case of any personnel action, as the secondary department, CSS chooses whether or not to concur in the recommendation originating from the faculty member's home department, but is not involved in the formulation of it.

In the matter of consultation regarding competitive or preemptive salary offers, CSS faculty has chosen to rely on the (default) position of the Handbook (full consultation in all cases) for dealing with preemptive or retention offers. This policy has been adopted for the 2007-09 biennium and will be reconsidered in subsequent biennia.

2. Mentoring of Junior Faculty

All junior faculty are mentored directly by the director. This includes, but is not limited to, their annual meeting to negotiate goals and objectives for each calendar year, making sure that the research goals and objectives are clearly formulated and feasible in scope.

The faculty are strongly encouraged to strike a balance between teaching, research, and service that ensures significant and appropriate accomplishment in each area. In particular, they are advised to start their research immediately upon arrival at UWB, actively involve undergraduates in it, and set goals that are likely to proceed toward presentation and publication within approximately two years. This ensures them of having some "product" when their case comes up for the intermediate three-year reappointment review.

The junior faculty are also mentored to consider sources of outside funding that include those that are particularly receptive to proposals from predominantly undergraduate institutions. In fact, our faculty have had success with RUI type funding from NSF.

Annually, each assistant professor is reviewed by their senior CSS colleagues for progress toward promotion and tenure. These reviews are thorough and very specific in their assessment of progress and the clarification of program expectations.

Thus far, only one CSS faculty member who had spent more than four quarters at UWB experienced considerable difficulty in startup of their research program. As an example of program mentorship, the director responded by assigning a senior faculty member to work closely with the assistant professor in an effort to improve both their teaching and scholarship. In that particular case, the faculty member chose to resign before a review was conducted for promotion and tenure.

All faculty, but especially the junior ones, are encouraged each year to participate in the faculty development writing circles at UWB. These groups have been instrumental in helping our faculty write about their scholarship in a timely manner. The CSS program provides a nominal level of financial support (less than $500) for participation in these circles. The program has also contracted with an experienced UWS staff member to counsel junior and mid-career faculty on effective grantsmanship. In addition, the CSS program provides encouragement and travel financial support to faculty seeking Federal funding for their research to visit program coordinators at the funding agencies to discuss their research plans and learn how they may fit in to the agency priorities.

3. Scholarship Impact

In Table C.1, the list of faculty and their research areas shows that CSS has a broad range of scholarship ongoing in the program. In keeping with the culture of UWB, these activities include both fundamental research in the computer science and software engineering areas and scholarship in a number of interdisciplinary applied areas.

Table C.1: CSS Faculty Research Areas

CSS Faculty	**Research Area**
Arnold Berger	Embedded systems research interests include applications of reconfigurable software to embedded systems and event-based software simulations in embedded systems.
Frank Cioch	Software comprehension, both as it relates to the software's internal characteristics and to its utilization in a particular environment. Software engineering techniques, tools and methods to any given situation, and tailoring their application, information sharing, communication difficulties and the type of learning that occurs during software development.
William Erdly	Organizational analysis techniques, workflow management systems, human computer interaction, software risk management, database design.
Munehiro Fukuda	Self-migrating computations, job coordination, parallel and distributed simulations, shared memory multiprocessor systems, grid computing environments.
Charles Jackels	Application of large-scale computational science methods to chemical and physical problems involving the ground and excited state properties of small molecules. Applied chemistry in service to Nicaraguan coffee farmers.

CSS Faculty	Research Area
Clark Olson	Computer vision, particularly object recognition, mapping and localization for mobile robots, and indexing in multimedia databases.
Michael Stiber	Biological nervous system function for application to machine intelligence: including areas of artificial intelligence, neural networks, bioinfomatics, robotics & scientific computing.
Kelvin Sung	The role of technology in supporting human communication, and how different media delivered by technology can better support the presentation of ideas.
Carol Zander	Research interests include object-oriented programming & design, programming languages and primarily computer science education.

The range of activity is clearly very broad. The record also shows a high level of productivity, with at least 68 presentations, 96 publications, and more than $600K in research grants over the last five years (see Table A.2 in Section A).

It is, of course, important that CSS faculty scholarship be read widely and has an impact on the broader community. In fact, it is a UW Handbook requirement for promotion to full professor that the candidate's work achieve "national or international recognition." One quantitative measure of publication's impact is a count of the number of citations it has received. In Table C.2 are reported total citation counts for the publications of the CSS faculty. (These faculty labels do not correspond to those used in previous tables/figures.) For those faculty publishing in the natural or social sciences these counts are taken from ISI, and for those who publish in the computer science or engineering areas, the counts are from Google Scholar, which is acknowledged to better capture appropriate citations in those areas. Counts vary greatly among differing research areas with different traditions and as faculty publication records vary in length from nearly four decades to less than one. But, the overall profile is one of publications that gain significant recognition.

Table C.2: Total Number of Citations

CSS Faculty	Number of Cited References
F1	30
F2	733
F3	247
F4	365
F5	489
F6	250
F7	210
F8	91
F9	70

Another measure of the impact of the CSS faculty scholarship comes from an examination of the type of research being done by individuals and the type of recognition it receives. Below are examples drawn from the scholarly efforts of the CSS faculty that are attaining widespread recognition:

- Professor Fukuda is supported by the NSF Middleware Program in his research of agent-based grid computing middleware. This work is not only Federally supported, but is presented and published at national and international meetings, and three graduate students from Ehime University in Japan have came to UWB to work on this project with Fukuda. Professor Fukuda has published and presented this work at a wide range of international venues. (Appendix G – Fukuda)
- Professor Olson has been supported by NASA's Jet Propulsion Laboratory doing computer vision research that has been instrumental in development of the software being utilized by the Mars rovers in recent exploration. Olson's work is well published and presented in important computer vision venues, and he has been recognized with a2005 NASA Space Act Award. (Appendix G – Olson)
- Professor Stiber has a long history of work on the interface of neuro- and computer science. Besides publications in important journals, his work has gained sufficient international attention that he was invited in 2007 to be part of the international organizing committee for the 2007 Neural Coding conference held in Montivideo, Uruguay in November 2007. (Appendix G – Stiber)

As further examples, pedagogical work within CSS with broad impact includes:

- Professor Berger's text book Hardware and Computer Organization: The Software Perspective is preparing the material for a second printing. Professor Berger has collaborated with researchers at Google to initiate a study of automated plagiarism detection. (Appendix G – Berger)
- Professor Erdly's work on technological education in the changing workforce has earned him acknowledgment in prestigious national panels including: (1) RATEC Technology Workforce Development Summit (2003) – Keynote Speaker, (2) CompTIA National Conference (2003) – Invited Session Panelist – Future Trends in Technology Education and (3) Workforce Development Council - Technology Workforce Summit (2000). (Appendix G – Erdly)
- Professor Sung's recent work on using game themes and gaming devices in introductory computer programming instruction has earned considerable national recognition, including the presentation of a whole-day workshop at the National 2008 SIGCSE Computer Science Education Conference. His textbook Essential Concepts for Building Interactive Computer Graphics Applications is anticipated to be quite widely adopted by computer graphics courses. (Appendix G – Sung)
- Professor Zander's work on teaching and learning computer science has become part of a large scale international consortium, with presentations at both national and international conferences. (Appendix G – Zander)

In conclusion, all of the mid-career faculty in CSS are doing scholarship at UWB that is gaining recognition and having an impact in the broader scientific and educational communities. The full professors in the program have been transforming their scholarship into new areas of increasing importance in fundamental, applied, and service areas:

- Professor Cioch is transitioning from the more traditional software engineering methodologies to examination of very current practices, such as agile programming.
- Professor Jackels, who has traditionally worked in computational chemistry, has more recently refocused his work in field chemistry in service to small-scale coffee farmers in Nicaragua.

4. Impediment

The greatest impediment to faculty scholarship in CSS, and in UWB more generally, is the very high institutional service load expected of mid-career faculty. As soon as a faculty member achieves tenure, the young nature of UWB demands that they devote significant efforts to institution building and faculty governance. With this much leadership responsibility falling upon associate professors, there is a real potential within CSS of developing a culture not supportive of full professional development.

For example, this year alone, CSS has research-active associate professors serving as chair of the general faculty organization (GFO) and as members of over ten campus- and university- wide committees and task forces. This has the very real effect of limiting their scholarly production and severely slowing down their progress toward promotion to full rank. The three most senior associate professors are all research active and intent on promotion, but have been at rank for 6, 8, and 11 years. In a more mature program with fewer of these extraordinary demands, at least two and probably all three of these associate professors would have been promoted to full professor by now. The program has had only one hire in its history at full professor (Charles Jackels) and has hired only one associate professor sufficiently experienced that his promotion followed quickly upon appointment (Frank Cioch).

Besides the burden of institution building, which is somewhat common to other programs at UWB, the next most serious impediment to faculty scholarship is the complete absence of graduate student collaborators, a condition unique to CSS. The MS program was designed with the expectation that some graduate students would choose to collaborate with CSS faculty in their scholarship. While the faculty generally have extensive records of undergraduate researchers collaborating with them, the lack of graduate student colleagues has restricted and limited their research in ways not commensurate with success at a research university. As one of the very few science or engineering academic units without graduate students at UW, CSS program scholarship has been surprisingly successful. But, this is not seen as a sustainable model in the longer term. The need to fund the MS program and admit CSS graduate students is not only an expected part of the UWB context, but is essential to strong growth in program research and external funding for it.

5. Staff Development and Productivity

The self-study guidelines specifically ask about location of faculty offices. At UWB, they are by design dispersed rather than being concentrated by programs. The CSS faculty, while dispersed over two buildings remain in close conversation with each other for several reasons. The programming faculty are clustered in one wing of the 3rd floor of UW1. Three software engineering faculty are clustered together on the 3rd floor of UW2. These buildings are small and adjacent to each other, so that this dispersal does not provide a significant barrier to communication. In addition, all of the program teaching and research labs are clustered together on the third floor of building UW1, adjacent to the program administrative office. This provides a center of activity that frequently brings faculty and students together.

Staff development has been a priority of the CSS program and has resulted in a highly productive and stable administrative staff. As an example, the staff is consistently encouraged to identify training opportunities on the UWB or UWS campuses and to attend them as part of their jobs. This has allowed the staff to move into new areas of technical support, such as providing data base, publication development, and web presentation. The senior professional staff member (Dina Meske) has assumed the role of lead in the professional development of the CSS staff so that they are able to accomplish an increasingly broad range of activities, such as academic advising, student recruitment, student career services, and research grant support. In recognition of this development, the staff have been supported with reclassifications and extra-step promotions that have resulted in increased pay. Finally, the lead professional staff member in CSS has been supported in her pursuit of a graduate degree in psychology through a minor rearrangement of her normal work week, allowing her to pursue an educational program that directly supports her role as Counseling Services Coordinator.

SECTION D – RELATIONSHIPS WITH OTHER UNITS

1. Faculty Collaborations

Collaboration in scholarship with colleagues at different campuses is especially valuable to CSS, since UWB is a small campus with a relatively limited set of prospective collaborators on campus. A number of CSS faculty have developed research and educational collaborations with individual faculty from other UW units:

- Professor Stiber has an adjunct appointment in UWS CSE and has collaborated with faculty in UWS Biology studying crab stomatogastric ganglion.
- Professor Olson has worked with graduate students in Computer Science and Engineering (CSE): Deepak Verma – Visual motion estimation using image features (Spring 2002). He has also with students in Electrical Engineering (EE): Ming Ye – Dense stereo matching using robust measures (Spring 2002) and Habib Abi-Rached – Wide-baseline stereo vision for Mars rovers (Summer 2002-Summer 2004)
- Professor Zander has collaborated with faculty at CSS-UWT and at CSE in computer science education research.
- Professor Sung has collaborated with faculty at UW-CSE and College of Education on an invited grant proposal to Microsoft Research for establishment of Center for Games for Learning. He has also collaborated with colleagues at UWS CSE, Washington State University Vancouver, and Cascadia Community College on a Microsoft Research funded project on Game-Themed Programming Assignments.

In addition, a number of faculty have collaborations with colleagues at other universities:

- Professor Stiber: Online Java laboratory for a Signal Computing Course with Arizona State University; Neural Coding with UCLA and Universidad de la República, Montevideo, Uruguay.
- Professor Sung: Top-Down Approach to Teaching Computer Graphics and Fast Ray-Tracing and the potential effects on Graphics and Gaming courses with University of Utah.
- Professor Zander: Threshold concepts in computer science and issues based on the threshold concept characteristics with University of Gävle (Sweden), Uppsala University (Sweden), University of Connecticut, Umeå University (Sweden), Rhode Island College, and Aberystwyth University (Wales); Software debugging and psychology of students with Metropolitan State University, Fort Lewis College, Xavier University, University of Technology, Sydney (Australia), College of Charleston, Pacific Lutheran University, University of California, San Diego and Aberystwyth University (Wales)
- Professor Fukuda: The AgentTeamwork mobile-agent-based grid-computing middlware research with Ehime University (Japan), University Cal Irvine, and Whitworth College; The super-scalable web-service research with Tokyo University of Engineering (Japan).

- Professor Erdly: Educational pathway research with Bellevue Community College.
- Professor Jackels: The chemistry of coffee processing on small farms in Nicaragua with Seattle University and la Universidad de Cetnro Americana Managua.

These research collaborations are all on an individual basis, without any formal institutional support or framework. Collaboration with a colleague at UWS or UWT, other than being proximate, is not much different than a long-distance collaboration.

Collaboration within UW could be effectively encouraged by providing institutional support for a limited number of RA's, giving our faculty the ability to have graduate students working in their labs in collaboration with the students' home department. This would be exceptionally important to UWB faculty, since with the MS program being inert, there are no graduate research students within their own unit. This would also tend to develop more robust research connections with the UWS research groups.

Collaboration on educational initiatives has proven successful at UWB. In one such initiative the CSS program collaborates with the UWB Business program to offer the Management Information Systems (MIS) concentration, which provides students the technical and business skills to solve business problems in technology-based environments. Students learn to analyze and design effective information systems, successfully manage software projects, and maximize online customer experiences. The concentration was developed in collaboration with the Business Administration faculty and included suggestions by an industry advisory board. Students in the MIS concentration take courses in both the Business and CSS programs. The faculty, as shown in Table D.1, are drawn from both programs and bring to it a diverse set of backgrounds.

Table D.1: MIS Concentration Faculty

Faculty Member	**Degree**
Frank Cioch, Professor	Ph.D., University of Michigan, Computer and Communications Sciences (CSS)
Sandeep Krishnamurthy, Associate Professor	Ph.D., University of Arizona (Business)
Alan Leong, Lecturer	M.S.E., University of Washington (Business)
Kelvin Sung, Associate Professor	Ph.D., University of Illinois at Urbana-Champaign, Computer Science (CSS)
Carol Zander, Senior Lecturer	M.S. Mathematics, University of Colorado and M.S. and Ph.D. Colorado State University in Computer Science

The MIS concentration represents a very successful collaboration that could serve as a model for future initiatives, especially as the STEM context at UWB is developed.

The Business program has had a very strong and successful entrepreneurship component, which has given rise to the Center for Student Entrepreneurship, housed in the Office of the Vice Chancellor. This center and its director Professor Leong, have been instrumental in helping a large number of students launch successful companies. In order to bring this opportunity to CSS students as well, CSS has regularly offered special topics courses in entrepreneurship that are open to both CSS and business students. These classes have served as launch platforms for several start-up companies involving CSS students, as shown in Table D.2.

Table D.2: Start-up Companies as a result of CSS Entrepreneurship special topic

Company Name	Founded By	Product/Service
IMCentric in Utah	Founded by Russell Thornton & Ben Hodson of the Business / CSS programs.	This company manages e-business security certificate renewals for major financial institutions.
Acirius	Founded by Bruce James (CSS) and he is now assisted by Adrian Synal and Ben Bromage (both of CSS).	This company produces applications for personal digital devices.
Rainfall Studios	Co-founded by Morgan Eason (CSS / Business).	A software gaming company in the developmental stage.
Gostnet	Co-founded and later sold by Gabe Frost (CSS). He went on to form a new company and created some intellectual property for licensing. He was recently hired as a program manager at Microsoft to lead a major initiative in their wireless space.	Wireless service to small towns.
Second Look Serriform	Founded by Tom Vu (Business) and Dan MacDonald (CSS). After graduation, Tom decided to terminate Second Look and he then co-founded Serriform. Serriform. Among the company employees are Dan MacDonald, Sue Craven (CSS Intern), Peter Chang (CSS grad), and Tim Karren (Business).	Serriform is a prestigious IT consultant to major corporations, and located on the 34th floor of the Union California Bank Building.
Point B Telematics	It is co-founded by Matt Scholz (CSS), Chris Whitten (CSS), and Enrique Alvarado (MBA).	A developmental stage company that seeks to provide routing and inventory services. This company is still in its initial phases, but has already developed some interesting IP.

2. Administrative Collaboration and Faculty Governance

There has been effective collaboration between the campuses in staffing committees for promotion, tenure, and faculty searches. In searching for colleagues with expertise in the candidate’s research area, these collaborations offer us a much larger pool of colleagues than we would have at UWB alone. This service flows both ways, and the UWB faculty are always eager to participate with the same levels of commitment and engagement that would be expected on their home campus.

Although informal, there is also an effective administrative collaboration between the directors/chairs of CSE (UWS) and CSS (UWT). CSS has always found them to be most helpful in sharing data, ideas, and experience as we cooperate to better serve the surrounding community and its students. This cooperation extends to the staff level as well as advisors share relevant information, student referrals, etc.

CSS faculty participate in institutional governance at many levels. All are active within CSS and its committees (see Appendix D). The CSS faculty are also very active at the campus level. The atypical demand of a young institution for high levels of service from mid-career faculty has been discussed earlier, and the CSS faculty provide exemplars of this phenomenon. At the campus and university level, this year alone, CSS is providing the following faculty governance service roles:

- GFO Chair
- GFO Executive Council member
- Academic Standards and Curriculum Council member
- Faculty Council Chair
- Faculty Council member
- Instructional and Research Support Committee member
- Senator and at least five councils or working groups of the UW Faculty Senate
- Members of at least nine UW administrative committees and task forces

As has been stated, service is expected of the faculty, even at junior stages of their careers. The faculty are deeply suspicious that this service, while necessary and valuable, is not greatly valued at the time of promotion and tenure or of merit review. Since, at UW, the interpretation of criteria for these personnel actions rest first and foremost with the faculty, this situation, if true, would be a reflection primarily of their colleagues' values. While a most serious problem, it is not clear what action the program administration should take to address it.

In 2004, the CSS faculty considered the possibility of developing program specific criteria and procedures for promotion and tenure actions. After thoughtful deliberation, the program mission statement (Appendix F) adequately expressed the broad understanding of scholarship to be encouraged within the program. The faculty also decided that the existing campus-wide document on procedures and criteria for promotion and tenure (from the UWB Faculty Handbook) was adequate for our purposes and should be used without further modification. These pages from the UWB Handbook are included in Appendix F.

SECTION E –DIVERSITY

1. Diversity in Faculty, Staff, and Students

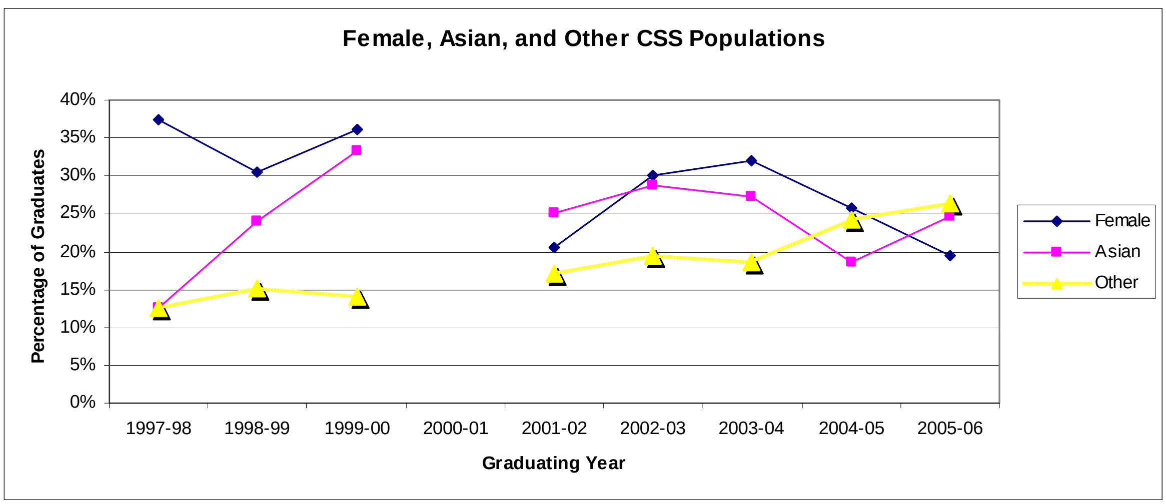
For comparison purposes, we have chosen to consider the ethnicity and gender data for the CSS graduates as reported by OIS for each graduating year. Data we have available is shown in Table E.1 and Figure E.1.

Table E.1: Diversity of CSS Graduates academic years 1997-2006 (except 2000-01) compared to UWB Student Body at present

Diversity category	CSS graduates over nine-year period	UWB student body at present
Female	28%	58%
Asian	26%	17%
African American	3%	3%
Hispanic	1.5%	5%
"Other"	19%	17%

The major differences between the CSS population and that of UWB more generally is that CSS has a significantly larger Asian student population and a much smaller female one. In Figure E.1 are displayed longitudinal data for women, Asian, and "other" students.

Figure E.1 Diversity in CSS Populations



These subpopulations have varied significantly over the years. The percentage of Asian students has remained generally in the 25-30% range, but that of the female population gives a suggestion of decline in recent years. The indications are that this decline is continuing and that the CSS student body is now only about 18% female. The fraction of students reporting "other" for ethnicity has risen in CSS during the last three years and at 26% is now considerably greater than for the campus as a whole. The national data for the computer science/engineering field as a whole for bachelors degree recipients is 14% female, 4% African American, and 18% Asian/Pacific Island.[4] While CSS has a larger fraction of Asian students than does the field nationally, the female population may be only slightly higher and is following the national decline.

The composition of the full-time CSS faculty is as follows: Caucasian male (6); Asian male (2); and Caucasian female (1). The composition of the full-time staff is three Caucasian females. Nationally, computer science tenure track faculty have approximately 15% female representation, 24% Asian/Pacific Islander, and 1% African American.[5]

The CSS students include a mix of traditional age students and older ones who are returning to school. As shown in Table E.2, the majority of CSS students are between 20 and 30 years of age. Compared to the campus-wide population, CSS has fewer students in the 18-20 age range and more in the 26-30 bracket. This is consistent with the presence of a significant number of CSS students returning to school after a period of employment.

Table E.2 Age Distribution of CSS and all UWB Students 2008

Age	CSS students	All UWB Students
Under 18	1%	0%
18-20	4%	16%
21-25	37%	39%
26-30	28%	16%
31-35	10%	7%
36-40	8%	6%
41-50	10%	12%
Over 50	2%	3%
Total	100%	99%

2. Teaching Loads

By design, teaching loads are similar for all full-time faculty on tenure track regardless of rank (nominal five courses plus capstone mentoring). Sr. Lecturers have one more course (six per year plus capstone mentoring). Except for small year-to-year fluctuations and relief due either to research funding or institutional service, all loads are the same. Data was presented in Sections B.1–B.2.

3. Steps Taken and Impediments

The ability to diversify the faculty has been hindered by the fact that the CSS program has not recruited a full-time faculty member since 2001. Unfortunately, over the life of the program, one

[4] Taulbee Survey Report 2005-06, Computer Research Association, March 2007. Tables 9 and 10.
[5] Taulbee Survey Report 2005-06, Computer Research Association, March 2007. Tables 21 and 22.

of the three faculty hires who did not persist to a tenure decision was an Asian woman. When she resigned from the program, that vacant line was reallocated due to under enrollment and was not refilled.

We will resume hiring at such time that the MS program is activated and, with that, will come another opportunity to diversify. At that time, we shall aggressively recruit female candidates for our faculty through our advertising and network of personal contacts. The search committee will include a female faculty member. The administration will be urged to provide the necessary support to recruit any suitable female candidates identified by the search committees.

Special efforts will be made by the director to connect any new female faculty with female mentors and with the broader network support community on the UWB and UWS campuses. The attempt will be made to link any new faculty members with Advance and the opportunities it provides. The present program leadership has participated in workshops provided by Advance to inform chairs about mentoring, supporting, and retaining female faculty members. It is expected that any future CSS director would do the same.

Professor Carol Zander, our only full-time female faculty member, has been with the CSS program since its first year and has been highly successful, both as a faculty member and as a role model for our students. She teaches some of the more technical and challenging programming courses, mentors the student ACM group, and has won the UWB Distinguished Teaching Award. Initially appointed as a Lecturer, Zander was shortly promoted to Senior Lecturer and has gained successful reappointments with long-term contracts. Her success has been considerable, and her posting is as secure as this class of position can become at the UW. She has had a wide range of leadership roles within the program and across the campus, including being the chair of the campus curriculum committee, a position of considerable influence.

Attempts to diversify the student body have been ongoing on a continuous basis. The program recruiters make regular visits to Seattle Central Community College, the only feeder institution in our primary recruitment region with significant African American student population. The program staff in its recruiting also makes special attempts to recruit female prospects as they visit classes and advising sessions at our feeder institutions. Female students figure prominently in the program’s recruitment literature. As often as is practical, our lone female faculty member participates in these recruiting exercises in an attempt to present a role model to prospects. In fairness, this is not overworked, and we have avoided making this a disproportionate service demand on Professor Zander as sometimes happens with faculty of underrepresented groups.

A number of initiatives have been undertaken within in the CSS program to ensure the success of our women students. Professors Stiber, Sung, and Zander have been awarded a Diversity Enhancement Grant by UWB to improve diversity in the CSS student body. The CSS staff has established a Peer Mentoring program, which includes an emphasis on identifying female mentors and inquiring of new female students as to whether they would like to have such a mentor. Female alumni and students are actively recruited to accompany the recruitment staff as they make presentations at our feeder institutions and to our own pre-major lower division students. The staff is currently working with our network of female students to see if they have sufficient interest in establishing a Women in Computing chapter at UWB as a networking vehicle. Finally, we look for opportunities such as the conferences sponsored by Women in Science and Engineering and solicit (and support) attendance by the female students. Program course scheduling design includes consideration to have our lone female faculty member's course load spread over both introductory and advanced programming courses, so that students see her as a role model over the full range of their academic career. Obviously, the ability to do this effectively is limited by having only one female faculty member.

Programmatically, two initiatives launched by the CSS program have been in part motivated by the desire to serve women students. In both cases, the philosophy of the initiative recognizes that many students are motivated more by the context of computing applications than by the nature of computing in itself. For example, students may be very interested in being a computer specialist within the area of healthcare informatics, but not as being a software developer in any number of unrelated but similar areas, such as E-commerce database implementation. It is also thought that women in science and engineering are often motivated more by interest in the ultimate application than by the nature of the tool being used.[6] The BAAC degree was designed to attract a new group of students who view computing as a tool and not as a career; we think that many women fall into this category. This degree speaks directly to the application oriented student and combines a technical education in CSS with coursework and integrative capstone project in the associated application area. The BAAC degree is being offered for the first time in Autumn '07, and it is too early to determine its appeal for diverse students. CSS has also added more courses which are expected to appeal to this more diverse group of students, including Digital Play – Fundamentals of Interactive Games; Social Aspects of Computing; Computers and Society; Programming with Video Games; Interdisciplinary Information Technology; Computer Animation; Entrepreneurship Seminar; and Business of Computing.

The other application-focused computer education path followed by students with undergraduate degrees in the application area is to obtain a second degree in a computer related area to complement their first degree. For some, this involves a second bachelor's degree in CSS, but for many others a master's degree would be more appropriate and efficient. With this in mind, the program eagerly awaits the activation of its MS degree, with a "career conversion" track being prominently featured. We expect that it not only will attract a large amount of interest from students with diverse backgrounds in varied areas, but that a significant fraction of that interest may be from female prospects.

4. University Programs

The CSS program makes no use of GOMAP because the MS program is inactive. The Office of Minority Affairs has a series of programs designed to attract minority applicants. However, UWB does not use the OMA in its recruiting. The Husky Promise program, providing full tuition for lower income students, is used for recruitment at UWB. This program, although only one year old, is expected to serve a diverse group of students.

5. Effects of Increased Diversity

There has been no increased diversity in CSS and, therefore, no effects of it to report. The program has created what is thought to be a very supportive and welcoming environment for the

[6] Jane Margolis, Allan Fisher and Faye Miller, **"**Caring About Connections: Gender and Computing", *IEEE Technology and Society*, December, 1999.Vol 18(4), pp 13-20.

underrepresented groups among our students. While we have reexamined those activities, listened to student feedback, and refined them, there has no significant increase in student diversity that, in turn, would have been expected to impact our program and bring about further changes in it.

SECTION F –DEGREE PROGRAMS

1. Doctoral Programs

None are offered or anticipated at UWB.

2. MS in Computing and Software Systems (MSCSS)

Background

A Masters degree in a computer science related field has been an objective of the campus from its founding. This degree is listed in the initial document from the HECB that served as the first UWB strategic plan.[7]

The CSS faculty decided in 2001 that, having fulfilled its initial mission of successful implementation of a BSCSS, it was time to develop a plan for accomplishing its role in graduate education as well. After careful planning and drafting by the CSS faculty and thorough review both within the University and from external reviewers, formal approval at the University and HECB levels was granted for the proposed MSCSS degree in 2002. The full proposal, as approved, is provided separately for this review by the Graduate School.

Due to a lack of new resources at both the state and university levels, the MS program has remained to this day "on the shelf" and ready for implementation. In 2006, re-review by the HECB was necessary to prevent the authorization for the MSCSS from lapsing due to inactivity. Upon receiving the request for approval extension from Interim Chancellor Olswang with the assurance that student demand was still high and that launch of the program was a campus funding priority (see correspondence in Appendix J), the HECB extended authority to offer the MSCSS through 2010 with the understanding that prior to actual student enrollment, an updated proposal would be reviewed and submitted. In particular, this revised proposal was to document continued demand for the program, explain any update of the curriculum, update the resources and costs of the program, and contain comments of at least two external reviewers.

In conversation with the HECB, it was learned that the present on-going University program review could also serve as such a re-review of the MS so long as: (1) the self-study contained an updated budget, student and community need statements, and explanation of any curricular revisions; and (2) that the report generated by this committee contain explicit discussion and recommendation of the appropriateness of this MS degree for implementation when funding is realized. This section is organized to facilitate that review and draws heavily upon the original proposal updated as appropriate.

Goals and Objectives

The goals and objectives of the MS program have not changed fundamentally during the five years since its inception. All of the feedback received from the community and prospective students has been that this program is well-focused on the educational needs of the area students and on the workforce needs of the regional economy.

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[7] *Design for the 21st Century: Expanding Higher Education Opportunity in Washington*, HECB, July 1990, p16.

The following description is taken from the original proposal:

> Like our undergraduate CSS degree, the MS in CSS is interdisciplinary. It is designed to accommodate the wide range of individuals from many different disciplines and backgrounds who determine, for various reasons, that they need more knowledge about computing and software systems.
>
> This includes applicants with undergraduate degrees in
>
> - computer science
> - information sciences and technical management
> - the wide range of engineering disciplines
> - the physical, life, and health sciences
> - the social sciences
> - the humanities
> - our own CSS undergraduates (both BS and BA degrees)
>
> The MS in CSS program will allow applicants with a BS degree to build upon the scientific methods of inquiry that they have developed as undergraduates and on the job. Meanwhile, the program will allow applicants with a BA degree to develop methods of scientific inquiry as they integrate their previous knowledge with the computing and software systems domain.
>
> The MS in CSS program is designed to serve both the unemployed and underemployed Puget Sound residents. It is anticipated that our graduates will use this degree for any of the following reasons:
>
> - to further advance their career in their current discipline
> - to transition to a career path that is more computing and software intensive
> - to pursue advanced education
>
> The curriculum is designed around the following program objectives. The program will prepare students to:
>
> - be proficient in identifying appropriate technological solutions to computing and software problems from their chosen application domain
> - apply critical thinking skills and cross-disciplinary knowledge to problems whose solutions require computing/software and application domain synthesis
> - develop effective oral and written communication skills and team membership skills
>
> The curriculum is designed to meet the following educational goals:
>
> 1. emphasize the methods of scientific inquiry, analysis and modeling used in computing and software systems
> 2. emphasize theoretical/conceptual knowledge as it relates to practical/how-to knowledge
> 3. emphasize the ability to synthesize and apply theories and techniques in a professional setting
>
> The curriculum is designed so that graduates of the program will have demonstrated the following learning outcomes:
>
> 1. demonstrate skill in analysis, problem solving and modeling through developing applications using programming and design languages at the level that makes them competitive for positions requiring software development

2. demonstrate effective oral and written communication skills and team member skills by working in a team environment that is designing, developing, testing, and documenting a software system
3. demonstrate self-directed learning, a foundation for the life-long pursuit of personal and professional educational goals, through the completion of a thesis/project

Curriculum

Curricula are structures that are expected to evolve as the faculty and students gain experience with them. In this case, the basic approach of serving a range of students who wish to enhance their education in computer-related areas *is still appropriate*. During the six years since program approval, we have discussed the MS curriculum with many prospective students and with employers in the community. A consistent message we receive is that the program remains highly relevant and that its emphasis on higher level analysis and thinking skills rather than more transient specialized technical skills should not be refocused. The curriculum is by design flexible enough to serve the evolving needs of our students.

The following is a description of the proposed curriculum that parallels a more detailed discussion found in the full MS proposal provided separately by the Graduate School.

The following five courses, or equivalent, are required for admission into the MS program:

- CSS 342, Mathematical Principles of Computing
- CSS 343, Data Structures and Algorithms
- CSS 360, Software Engineering
- CSS 370, Analysis and Design
- Discrete mathematics or linear algebra

While students with baccalaureate degrees in computer science or closely related disciplines are likely to have these, it is recognized that those with their BA or BS degrees in other disciplines may be missing all or some part of these. To facilitate their entry into the program, a set of background courses offered at the graduate level are planned. There are three background courses that the applicant may be required to take:

- CSS 501: Data Structures/Algorithms and Object-Oriented Programming
- CSS 502: Discrete Mathematics
- CSS 503: Software and Requirements Engineering

See Appendix K for a detailed description of these courses.

Upon matriculation into the MS program, all students will be required to complete 45 credits of coursework. This translates to 7 five-credit courses and 10 credits of thesis/project. Students proceed on to specialized electives after taking between 3-5 core courses chosen from the 4 groups in Table F.1. Students with more extensive backgrounds in the closely related areas (e.g., database systems or networking) will replace some of the Systems Group requirements with additional specialized electives, for a total of 20 credits from the Systems Group and Specialized Electives. All students will complete either a thesis or capstone project for 10 credits.

Table F.1: MS Degree: Course areas and Credit Hour breakdown

Courses	**Credit Hours**
Core Courses	15, 20 or 25 credits
Programming Group	5 credits
Design Group	5 credits
Foundations Group	5 credits
Systems Group	0, 5, or 10 credits: if taken as an undergrad, can substitute electives
Specialized CSS Electives	10, 15 or 20 credits
Thesis or Project	10 credits

Coursework Graduation Requirements: 45 credits total, with one of the following breakdowns, depending on undergraduate preparation:

- 15 core, 20 electives, 10 thesis/project, or
- 20 core, 15 electives, 10 thesis/project, or
- 25 core, 10 electives, 10 thesis/project

The purpose of the programming and design groups (see Table F.1) is to provide the student with problems that require them to demonstrate skill in analysis, problem solving and modeling through developing applications using programming or design languages, respectively, at the level that makes them competitive for positions requiring software development. In these two groups, students will also demonstrate effective oral and written communication skills and team member skills by working in a team environment that is designing or coding a software system. The courses in the two groups will differ primarily by the language used and the stage of the software development life cycle model in which the activity resides (implementation/coding or design).

The purpose of the foundations group (see Table F.1) is to emphasize the methods of scientific inquiry and emphasize theoretical/conceptual knowledge as it relates to practical/how-to knowledge. The foundations group also covers ethical issues that arise in computing and software systems. Courses in this group provide the student with problems that emphasize the ability to synthesize and apply theories and techniques in a professional setting. Specifically, they address the relationship between mathematical and/or scientific foundations and actual practice.

The purpose of the systems group (see Table F.1) is to provide the student with an exposure to the technologies and methods used in the types of computing and software systems that they will be interacting with as a software developer. This includes courses such as operating systems, database systems, distributed/networked systems and computer organization and hardware. It is expected that the student will earn up to ten credits from courses in this group. Students with an undergraduate degree in computer science will have already taken some of these courses. Such students may substitute electives for courses in this group. Students who have not had exposure to any of these courses will be required to take two courses in this group.

The purpose of the specialized CSS electives (see Table F.1) is to provide students with the advanced background in a specific area necessary to complete a thesis or project in that area. It is anticipated that faculty will develop new 500-level courses in their areas of expertise to prepare students to work with them on a thesis or project in that area.

Finally, students will be required to complete either a ten-credit thesis or a project (see Table F.1). The choice between thesis and project allows a wide range of educational outcomes to suit the students' backgrounds and interests. A thesis might involve either the testing of a new idea or the synthesis or analysis of existing ideas. A project might involve the production of a product, such as a software system.

The MS proposal and Appendix K contain course descriptions likely to be offered during the first year in the programming and design groups. Courses in the systems group would be derived from existing 400-level courses presently taught in the same areas for BS students. The specialized electives would await development until the interests of the first student cohort were known. These would then be developed and offered for them in time to prepare for their project and thesis work. Initially, these would be offered as special topics courses until patterns of demand became apparent.

Employer/Market Demand Update

This section should be viewed as an update of the thorough needs assessment presented in Section II.B of the approved MS Proposal. Although the region had experienced a job slump following the collapse of the dot-com high technology sector in 2000-01, the research reported by the proposal and the needs assessments of the regional community indicated even then a continuing need for graduates with skills such as those developed in the MS program. While indeed the dot-com sector had shrunk, other sectors of the information technology sector were continuing to grow and were demanding increasingly sophisticated employees. Nationally and regionally, that job slump is well behind us, and this section documents that the demand has returned to very high levels.

Since 2002, the demand for computer-related employees has continued to grow, as indicated by:

- the national figures published by the Association of Computing Machinery showing more computer related jobs than before the dot-com collapse[8]
- the Dept of Labor statistics showing that, projected for 2006-16,computer related jobs account for 5 of the 27 fastest growing job categories in the nation (including 2 of the top 4)[9]
- the 2007 Washington State Labor Market and Economic Report showing annual growth in computer related jobs of approximately 2.8%[10]

Although software jobs in some limited sectors (e.g., dot-com) declined somewhat, no statistics indicated anything other than a strong overall growth in demand for employees with computer-related skills.

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[8] David A. Patterson, "Restoring the Popularity of Computer Science," Communications of the ACM, vol 48 (9), Sep 2005, pp 25-28.

[9] Arlene Dohm and Lynn Shniper, "Occupational Employment Projections to 2016," Monthly Labor Review, Nov 2007, Table 2, p. 95. (Bureau of Labor Statistics)

[10] Washington State Employment Security Dept, http://govdocs.evergreen.edu/wastate/wslmia/almer/2007annrept.pdf

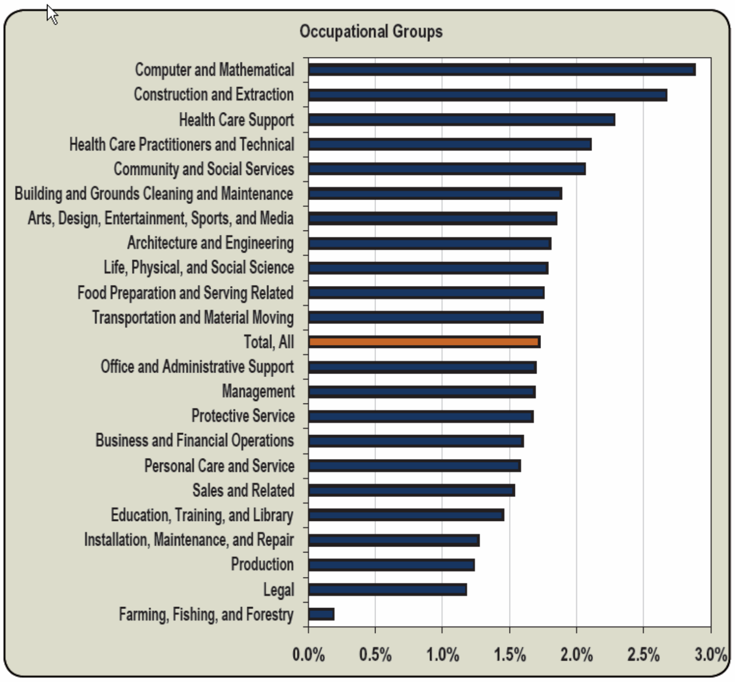
To provide concrete data, Table F.2 is an update of the fastest growing occupations along with the expected number of new jobs and its percent increase over the period 2006-16, which indicates a promising national job outlook for positions appropriate to MSCSS graduates.

Table F.2: Fastest Growing Occupations, 2006-16

Job	**number of new jobs**	**% increase**
Network systems and data communications analysts	140,000	53%
Computer software engineers, applications	226,000	45%
Computer Systems Analysts	146,000	29%
Database Administrators	34,000	29%
Computer software engineers, systems software	99,000	28%
Derived from "Fastest Growing Occupations, 2006-16" from the Bureau of Labor Statistics		

Figure F.1 taken from the Washington State Labor Market and Economic Report [11] shows that "Computer and Mathematical" occupations are not only very fast growing, with a projected annual growth rate of 2.8%, but are the fastest growing such category in Washington State.

Figure F.1: Occupational Groups



Another indication of this situation is that the HECB continues to place computer science degrees on its high demand list of critical needs.[12] Finally, we note that our BS graduates are

[11] Washington State Labor Market and Economic Report, Dec 2007, WA State Employment Security Dept. Fig 47

[12] State and Regional Needs Assessment Report. February 2006 (revised). Page 4. Author: Washington Higher Education Coordinating Board.

being sought in a very recruit intensive manner, with signing bonuses and high salaries again figuring in the situation.

There is no question that the national and regional job markets require more workers with the type of education that the MSCSS would provide. These markets supported the program when proposed five years ago, would have welcomed it throughout this hiatus, and would very much benefit from its presence at this time.

Student Demand Update

While the workforce demand for programs like the MS degree is strongly supported by all of the national and regional statistics, such a program must also experience significant student demand in order to fulfill its promise. This section should be viewed as an update of the thorough demonstration of student demand found in Section II.C of the MS Proposal. Although national student demand for computer-related education in general did drop somewhat over the last five years, it has now turned around, as measured by an increase in student interest in computer science and engineering majors.[13] The experience with transfer applicants to the BSCSS program has indeed mirrored this pattern, with the first increase in autumn term admissions in five years occurring Autumn 2007.

Even though this change indicates a general upturn in student interest, we are confident that the *MS program student demand never really slumped* like the overall demand level and will now grow even more quickly. The reasons for this optimism are first of all empirical. The program office has received a nonstop stream of inquiries from students about the availability of the MS program throughout this five-year hiatus. It is noteworthy that this considerable interest in the program was generated by only a web page indicating that the program was likely to be launched in Autumn 08, an overly optimistic assessment as it turns out. A survey was sent out in May 2007 soliciting interest in the MS program, and a total of 47 inquiries were received. Among these are 24 prospective students employed by companies that will pay for their further education. These companies are major employers in the region (including Microsoft, Boeing, IBM, Amazon.com, RealNetworks, Inc., Siemens Medical Solutions, Nokia Siemens Networks, VMC, IDD Aerospace, Durham Geo Slope Indicator, Constellation HomeBuilder Systems, and Sonosite Inc.). Half of the inquires were from alumni working at Microsoft.

Another piece of evidence of strong student interest is the success of the MS in CSS at UWT. It is a program similar in philosophy to our own and launched at approximately the same time as our present one was approved. It has consistently enrolled approximately 50-60 students (approximately 30 full-time equivalents) during this time of lower student interest (See Table F.3) and is now poised for growth as the field generally picks up.

*Table F.3: UWT CSS Graduate Enrollment**

	Autumn		Winter		Spring		Yearly Average	
	Headcount	**FTE**	**Headcount**	**FTE**	**Headcount**	**FTE**	**Headcount**	**FTE**
2002-03	26	17.5	28	18	38	21	30.7	18.8
2003-04	61	38	56	29.8	55	30.9	57.3	32.9

[13] Taulbee Report. "CRA Taulbee Survey 2006-2006," Fig 7, p.23.

	Autumn		Winter		Spring		Yearly Average	
	Headcount	FTE	Headcount	FTE	Headcount	FTE	Headcount	FTE
2004-05	66	39	60	28.9	52	30.7	59.3	32.9
2005-06	58	36	58	29.2	53	28.2	56.3	31.1
2006-07	48	20.1	52	31.6	43	33.6	47.7	28.4
2007-08	41	21.4						
*NOTE: Enrollment figures are not 10th day, but end of the quarter numbers								

It is worth noting that, unlike Bothell, Tacoma is not situated directly within the high technology corridor on the eastside and downtown of Seattle. Therefore, successful launch of the MS program in Tacoma during these years makes us confident that a similar program in Bothell would have flourished then and, without any doubt, would do so now. As described in the proposal, the competition closer to Bothell (UWS and Seattle U) offer masters degrees aimed more exclusively at the working professional with a BS in computer science, whereas our program includes a "career conversion" track for people with other undergraduate educations.

Finally, we note anecdotally that when we indicate to the many prospective students that the MS degree is "still pending activation," they uniformly express dismay and frustration, *having very few other options available to them* in their present circumstances. When we describe this situation to our industry/business/state government contacts, they are simply incredulous at this failure to strategically address these serious regional employment needs.

Budget Update

The budget for the MSCSS program as originally proposed in 2002 has been updated in a manner largely reflecting inflation. Some funds would be needed during academic year 2008-09 for program promotion, recruitment, and admissions. Most funding would begin in "Year 1," 2009-10. As before, it is proposed to phase in both enrollment and faculty staffing over a three year period beginning in 2009-10, with full strength of sixty student and four faculty FTE's.

The changes from the original budget are as follows:

- the professional staff position begins at 0.5 FTE and is phased in over three years
- reduction of system administration and academic services support staff needs by 50% to 0.5 and 0.25 FTE, respectively
- conversion of a 0.5 FTE technical support staff position to a more flexible arrangement using graduate assistants
- elimination of temporary start-up funding for facilities conversion, since the program will instead share laboratories with the undergraduate program
- reflection of a reassessment of needs in accordance with current costs (minor changes)

In Table F.4 is presented the Summary of Costs in the same format as required for formal program proposals. Costs are reported for Year 1 (2009-10), Year 3 (2011-12), and Year 5 (2013-14) and 4% inflation is estimated over that time. The "bottom line" is that after five years and at full growth, the cost of the MS program ($925K) is estimated to be only 46% of the program's estimated revenue ($1,992K). This percentage is in alignment with general campus experience when the non-academic costs such as system administration, academic services, and library resources are included, *as they are here*.

Table F.4: Summary of Costs (assumes inflation rate of 4%)

	FTEs			Costs		
Line Item	**Year 1**	**Year 3**	**Year 5**	**Year 1 2009-10**	**Year 3 2011-12**	**Year 5 2013-14**
Faculty Salary						
Program Direction/Faculty	0.25	0.5	0.5	$45,488	$98,399	$106,428
Program Instruction/Faculty	1	4	4	$121,300	$524,792	$567,615
Faculty Total				**$166,788**	**$623,191**	**$674,043**
Staff Salary						
Advisor/Recruiter/Admin Assistance (Prof Staff)	0.5	1	1	$36,960	$79,952	$86,476
System Administration (Prof Staff)	0.25	0.5	0.5	$26,180	$56,633	$61,254
Academic Services (Prof Staff)	0.25	0.25	0.25	$18,480	$19,988	$21,619
Tech Support (students/hourly)	0.00	0.00	0.00	$0	$0	$0
Staff Total				**$81,620**	**$156,572**	**$169,349**
Total Salary and Benefits				**$248,408**	**$779,763**	**$843,392**
Non-Personnel						
Local Travel/Recruitment/Publicity				$8,000	$8,653	$9,359
Operations Budget (Faculty/Staff)				$6,188	$20,625	$20,625
Software				$15,000	$16,224	$17,548
Lab Equipment				$0	$15,600	$16,873
Library Resources				$15,000	$16,224	$17,548
Total Non-Personnel (recurring)				$44,188	$77,326	$81,953
Start-up Costs (non-recurring)				$25,200	$0	$0
Estimated Annual Costs (recurring)				**$292,595**	**$857,089**	**$925,345**
Student FTE's	15	60	60			
Revenue				**$409,799**	**$1,807,215**	**$1,992,454**

The overall situation for the MSCSS degree is essentially unchanged since its approval in 2002: (1) the student demand is evident and persistent; (2) the employer demand for graduates of such a program is stronger than at any recent time; (3) the curriculum remains innovative and highly relevant; and (4) the costs of the program are projected to be well within the fraction of anticipated revenue common for UWB. In our judgment, the MSCSS clearly merits not only enthusiastic re-review by the present committee but vigorous support from the UWB administration for immediate launch.

3. BS in Computing and Software Systems (BSCSS)

Background

The BSCSS degree was the first degree program offered by the CSS program and until Autumn 2007 was the only one with enrolled students. Since UWB enrolled only upper division transfer students as undergraduates initially, the degree was required to serve transfer students efficiently. Building on the foundation work of earlier committees, a task force chaired by Professor Erdly prepared the formal proposal for the BSCSS degree during the 1995-96 academic year. This proposal was approved by the HECB in July 1996, and the first students matriculated in September of that year. The degree program grew very rapidly, with an enrollment exceeding 200 FTE by the 2000-01 academic year. While the BS curriculum has experienced revision as described below, the objectives of it remain essentially the same as originally proposed.

Objectives

The BSCSS degree, while drawing heavily on computer science and software engineering, was designed to focus on a set of layered competencies that regional and national leaders in the technology sector had identified as being most important. These layers, progressing from the most general to the most specific, are foundational, technical, and specialized. An objective of the program was that every student would receive a thorough education across all three competency layers.

Each course within the BS core curriculum would embed the full range of foundational competencies, which were grouped into three categories: Analysis and Problem Solving; Interpersonal Skills, and Management Skills. These competencies are found throughout the curriculum and are central to it because they are the ones identified as necessary for success across a broad range of jobs and occupations.

It is an objective of the program that each student will gain a wide range of technical competencies. These are grouped in the following categories: General Business, Social and Technical; Applications Programming; Infrastructure/Operations; and Information Engineering. Each course focuses on a subset of these technical competencies. The requirement of eight core courses in CSS combined with at least five upper level elective courses in CSS provides assurance that every student will achieve technical competency across all four of these groupings. As shown in Appendix N, the competencies included in each of the core courses map across the entire set of Technical Competencies with each one being addressed several times.

Building on the foundational and technical competencies achieved, the third objective of the program is to provide sufficient specialized competencies such that students are able to be immediately competitive upon graduation and able to use the very latest tools in applying the underlying competencies to relevant problems. The specialized competencies include such things as specific programming languages, database tools, network information transmission protocols, and automated tools for software engineering.

Experiential Learning

An educational objective of the BS degree is to provide every student with a significant experiential learning experience, through either cooperative educational projects sited within the regional industry, government, or nonprofit sectors or an undergraduate research experience in the laboratory of one of the program faculty.

Therefore, all BSCSS students are required to have a ten-credit (400 hour) Cooperative Education project. In the typical industrial setting, this is either a full-time experience for one quarter or a half-time one or two quarters. The success of the experience is evaluated with a final project report and colloquium presentations. Besides being an extremely valuable part of our students' education, the cooperative education capstone serves to keep the program in close touch with the computing-related needs of the surrounding community where these projects are sited. To facilitate this process, the program has a Program Coordinator staff person, who devotes 50% of her effort to the cooperative education (internship) program.

Alternatively, approximately 17% of our students choose to accomplish this experience as undergraduate researchers in the laboratory of one of our faculty. As is typical in the sciences, these students work side-by-side with their faculty mentor on a research project that is some part of the mentor's faculty research program. Besides the colloquium presentations and project final reports expected of all capstone students, the undergraduate researchers often become coauthors and co-presenters of papers in scholarly venues. These research activities then form the basis for student attendance at professional meetings. In fact, our undergraduate students have been listed as coauthors on at least 17 journal papers or refereed conference papers and presentations.

Our Cooperative Education requirement has been designed flexibly enough that it serves well to provide either a practical project-oriented experience as would be typical in engineering contexts or an undergraduate research opportunity as would be more typical in science departments.

Another programmatic objective was to make the BSCSS degree such that its curricular requirements articulated smoothly with the preparations available to our students at the regional community colleges. This was accomplished by working with each regional community college to ensure that it offered courses that would serve as appropriate prerequisites for the CSS degree.

Curriculum

The BSCSS curriculum is fully described in Appendix L. It has evolved from the original one approved in 1996 through a major modification of April 2001 and the other minor ones through the years. The original curriculum had three formally defined concentrations: Systems Analysis, Application Programming, and Information Engineering, with three specific 400-level courses required for each one. This requirement mandated that these courses be offered multiple times every year in order to allow students to make timely progress toward graduation. Experience showed that this structure was overly rigid both from the administrative point of view and from the perspective of the range of student interests and needs. In some cases, it was inhibiting the students from obtaining the most effective education.

In Spring 2001, the formal concentration requirement was eliminated, thereby allowing the students more flexibility in selecting their 400-level courses and, in effect, providing a wider range of tracks through the curriculum. It is noted that all of the specific courses mandated by the original concentrations are still available within the curriculum on a schedule dictated by student demand.

The following provides an overview of the BS curriculum, with details presented in the Appendix L. Unless noted otherwise, all courses discussed are 5-credit quarter courses.

Lower division preparation for the BS major includes 7 specific courses, as follows:

- composition and writing (2)
- introductory CS1/CS2 computer programming (2)
- calculus (2)
- statistics (1)

Great care has been taken to assure that these requirements align efficiently with courses offered by each of our community college feeder institutions and by the UW Seattle, since the majority of our students transfer to UWB after completing approximately 90-credits of college work. Starting in 2006, with the enrollment of our first lower division students, we have also ensured that these courses are available on a regular basis at UWB.

Building on the lower division courses listed above, the BS curriculum is structured in 3 components: core courses, elective courses, and cooperative education project. All BS students take a series of 8 core courses, as follows:

- Technical Writing for Computing Professionals (CSS 301)
- Mathematical Principles of Computing (CSS 342 or 263)
- Data Structures and Algorithms (CSS 343)
- Management Principles for Computing Professionals (CSS 350)
- Software Engineering (CSS 360)
- Analysis and Design (CSS 370)
- Hardware and Computer Organization (CSS 422)
- Operating Systems (CSS 430)

These courses provide the foundational and technical competencies through the study of computer programming, software engineering, management, and technical communications.

Students select from among a wide range of elective courses to accompany the core courses. Through these courses the students can develop the technical and specialized competencies that best suit their interests and career goals. Students are required to take 25 credits (5 courses) of CSS electives. In addition, they have 15 additional upper division elective credits (3 courses) that may be taken either from CSS offerings or from those of other programs. This is a requirement of at least 65 credits from within CSS in addition to the introductory 100-level programming courses (10 credits). Elective courses are regularly offered in the areas that include software engineering methodologies, computer vision, computer graphics, artificial intelligence, embedded systems, scientific computing, health care informatics, digital game design, computer networks, database management, advanced program design, competitive engineering, artificial neuron-networks, grid computing, human computer interaction, and others.

Finally, as a capstone project, each student takes CSS 497, Cooperative Education (CE also referred to as their Internship), most often as a 10-credit project in a working setting. A contract is negotiated between the student, a faculty mentor, and external sponsor, that identifies student competencies to be demonstrated during the course of the project and, often, additional specialized competencies to be acquired. As an alternative form of CSS 497, approximately 10-20% of our students choose to complete an undergraduate research project in a faculty laboratory. At the completion of these projects, the students present the results to a public audience both in poster and oral format. A key part of this presentation is a reflection by the students on how the competencies acquired at UWB enabled them to successfully complete their cooperative education project, whether off-campus internship or undergraduate research.

In summary, the total requirement for graduation with a BS degree includes a minimum of 10 introductory 100-level credits, 65 credits of CSS core and elective courses, and 10 credits of Cooperative Education, for a total of 85 college credits out of the 180 required for a degree. This compares very favorably with BS degrees at other institutions, as shown in Table F.5.

Table F.5: Number of Computer Science Credits required for BS Degree

Campus Program	# of Credits
UWB - CSS	85
UWT - CSS	85
UWS - CSE	65
WWU - CS	75
Seattle U - CS	84

Standards for Measuring Success

From the students' point of view, an extremely important success indicator is the preparation they have received to enter the job market upon graduation. As discussed in Sec A.2.b, a high percentage of graduating students are not only well prepared for professional positions, but actually have them secured by the time of their graduation. The record of student success within our curriculum was also examined in that section, and it was shown that an increasingly high percentage of CSS students make satisfactory progress through the more challenging aspects of the curriculum. The good success of CSS students is also reflected in the state mandated efficiency metrics, discussed below in the present section.

As an indication of the success of the CSS curriculum in preparing the students for their "real world" Cooperative Education (CE) project (aka, Internship), they are required to list in their CE contract those program competencies that will enable them to carry out their project. In the period Autumn 06 through Summer 07, the 47 CE contracts listed competencies in the following groups (see "Objectives" above) with the number of competencies required to perform the work in parentheses: Foundations (85); General Business, Social and Technical (74); Application Programming Technical (58); Infrastructure/Operations Technical (50); and Advanced Specialized Technical (44). By the students' estimation, the average project required nearly two foundational competencies, four technical competencies, as well as advanced specialized technical competency. It should be noted that the students themselves recognized that they had achieved these competencies and that these competencies were relevant to their professional requirements.

At completion of the students' CE projects and as part of their oral presentation at the Internship Colloquium, they recap how these competencies and their various courses proved useful during their project. It is our observation anecdotally that more often than not, the students focus on the basic foundational and technical competencies rather than advanced ones, as enabling them to address unfamiliar and unexpected contexts as they arose in the real work place.

Program Assessment

The CSS faculty responds to student matters by way of advisors and faculty through the Curriculum Committee, Admission Committee, Strategic Initiatives Committee, and the director. Student comments are provided to the advising staff and the director directly and indirectly through course grades and self-evaluations of teaching. The program advisor provides a venue for students to discuss their progress towards a degree as well as offer program suggestions. Student feedback is provided through course evaluations, anonymous web e-mail, feedback from the CSS student organization, and public forums such as a quarterly meeting with the director, "Conversations with the Director." These opportunities promote informal conversations and are a regular event co-sponsored by the director and the CSS student organization and attended by other faculty, staff, and students.

Many feedback loops are in place to ensure student concerns are moved to the whole faculty. More systemic or problematic issues are forwarded to the director who also serves as the Undergraduate Program Coordinator and meets weekly with the CSS Advisor. Next in line are the program's curriculum, admission committee and Strategic Initiatives Committee. Recommendations from these committees and the director may be brought to the entire faculty, as part of a holistic assessment process which may include curricular review.

During the program's first decade major curricular revisions have been undertaken as a result of this process in order to add student course flexibility and provide a broader range of educational tracks. These changes were necessary to increase the program's ability to respond to a rapidly changing high-tech profession. Changes to the program have been made to accommodate lower division classes.

The UW maintains a periodic program review system (for which this self-study has been prepared) that includes UW and external reviewers. In addition, CSS is reviewed as a part of UWB for academic accreditation. Professional accreditation has not been sought for the existing BSCSS degree and it is not anticipated for the BAAC. We note that the CSS program has received no requests by either students or the industrial community to provide accredited degrees in software systems.

Student Assessment Strategy

Students are assessed by various methods that are oriented towards ensuring that the student's educational outcomes are being met. The department uses several forms of assessment:

- Course grades
- Course student evaluations
- Student exit survey
- Student Graduation Requirements Audit
- Senior capstone project

Course grades: For those learning competency outcomes that are closely matched to specific course content, student grades provide an excellent measure of satisfaction of outcomes. The advising staff reviews all grades each quarter and identifies students that are not making satisfactory progress towards the degree. These students are called in for an appointment with an advisor to discuss what measures they should take to remedy the situation. The program hires students to tutor in our drop-in computer labs, and there are additional tutors for CSS courses available through the Quantitative Skills Center. CSS provides a peer mentoring program for newly admitted students that matches them with an alumni or a senior to provide mentoring.

Course student evaluations: All courses in the program are formally evaluated by students through OEA-sponsored surveys. The director reviews the OEA results and student comments for every course each quarter.

Student exit survey: Students are administered exit surveys at the end of their senior capstone project. These surveys assist the program in evaluating domain areas and career paths, and allows for program suggestions.

Student Graduation Requirements Audits: The audits show how a student's UW courses, transfer courses, and courses in progress apply toward degree requirements. It will be used as a tool to aid faculty in creating new cluster courses for students in domain areas.

The senior capstone course CSS 497 Cooperative Education (CE). CSS 497is the final core requirement and the program capstone course for advanced CSS students. Cooperative Education provides students with the opportunity to earn academic credits while working on a project that has potential benefits for industry or community organizations. Typically students complete 10 credits (400 hours) of Cooperative Education in their final quarter(s). With guidance from a faculty advisor, students implement a working knowledge of their computing skills within the context of their field of interests. The faculty member requires academic deliverables during the course of the project. Upon the completion of the cooperative education the student is required to present their project at the CSS Colloquium. The Colloquium includes a poster presentation, and a 10-15 minute oral presentation that describes their experiences and accomplishments in fulfilling their cooperative education requirement.

The combination of all of these metrics provides the program with a wide-ranging picture of the relative strength of the curriculum and the progress of its students as seen from the point of view of most of our constituents.

Retention and Student Success

The CSS student services staff has a proactive philosophy. At least one hour is spent during the orientation with each student individually to ensure the curriculum is understood, the progression of classes, and individual schedules are created that address part-time or full-time status. During orientation, students are introduced to all of the advising tools including DARS, career resources, computing resources, student chapters of professional societies, academic standards, DSS, etc.

An important foundational understanding for students who are part-time or who work full-time is to understand good time management principles and to be able to plan their schedules on a yearly basis. To assist them, CSS guarantees these students that the core curriculum courses will be taught once a year and produces many advising tools to allow students to plan their evening course schedule. Many students come in for an advising appointment once a year or more often.

Students' academic progress is monitored on a quarterly basis, and based on this information, students with low scholarship are brought in for an advising appointment. Advising staff are available by phone, e-mail, and in person by appointment or on a drop-in basis for quick questions.

CSS maintains an e-mail listserv for our students. This has been an effective communication tool for CSS social events, emergency campus closure information, registration and graduation application planning, scholarly events such as professional society meetings, and seminar information.

The CSS student services staff members provide a peer mentoring program for new students. Seniors and alumni are given a training session prior to becoming a mentor for a new student. Many of the students who were mentored choose to become a mentor for new students in subsequent quarters. This program has been an effective retention tool with only one student who was mentored dropping out of the CSS program.

CSS staff provides support for the student chapter of the Association for Computing Machinery (ACM). Besides producing 3-4 social events each quarter, the student officers for ACM encourages industry contacts. The demand for computing students has been significant in the past two years reflecting the regional upswing in software development. Through ACM, we support the students in bringing IT recruiters to campus and provide an e-mail service for students and alumni for current job opportunities. Our e-mail list has averaged approximately 30-40 announcements per month in 2007 and 2008. In addition, we provide resume checks and provide the opportunity for students to participate in mock technical interviews. As the only STEM program at UWB, the CSS staff aids students with job search and career and internship assistance. These services are supplemented by our emphasis on networking with fellow students and alumni and a variety of jobs through internship projects in CSS 497. These communications and events coordinated by CSS student services help to connect students and alumni to the program and to the campus.

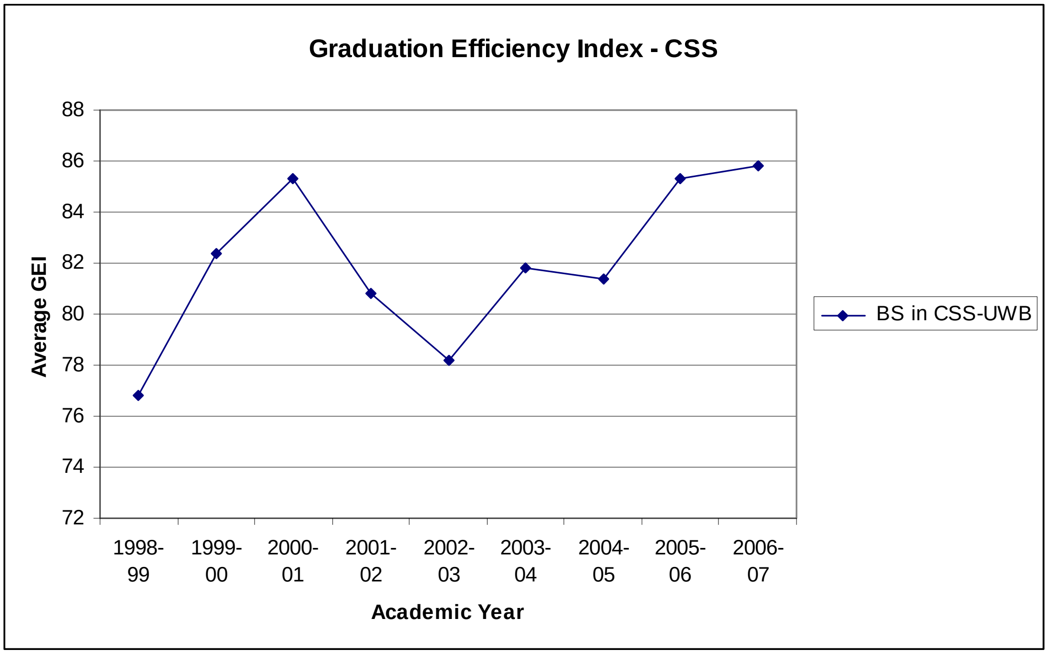
State Mandates

The Graduation Efficiency Index (GEI) and Time-to-Degree are two state mandated measures of efficiency discussed in this section.

The measure most appropriate to a setting such as ours, with a large number of part-time students, is the GEI. This measures the efficiency with which courses taken by the student result in progress toward graduation. It does not penalize a population of part-time, but otherwise very efficient, students. A high level of efficiency would indicate that the students in the program are well prepared and are taught effectively, resulting in relatively low failure/retake rates. A high level of efficiency would also indicate that the students are receiving good academic advising and are not taking courses that are inappropriate for them or do not lead them toward their educational goal.

Since almost all of the CSS students to date, have been transfer students, we limit our discussion and comparisons to the GEI numbers for transfer students, which are generally somewhat lower than for non-transfer students at UW. In Figure F.2, the GEI as compiled by the OIS for the BSCSS as a function of school year are shown. It is noted that this rate has generally risen to approximately 85%. This improvement trend since 2002 coincides with attempts by the program to require adequate prerequisite preparation and to be more diagnostic in our admission decisions. These changes result in fewer instances of failed and repeated courses and, consequently, greater efficiency.

Figure F.2: CSS Graduation Efficiency by Academic year



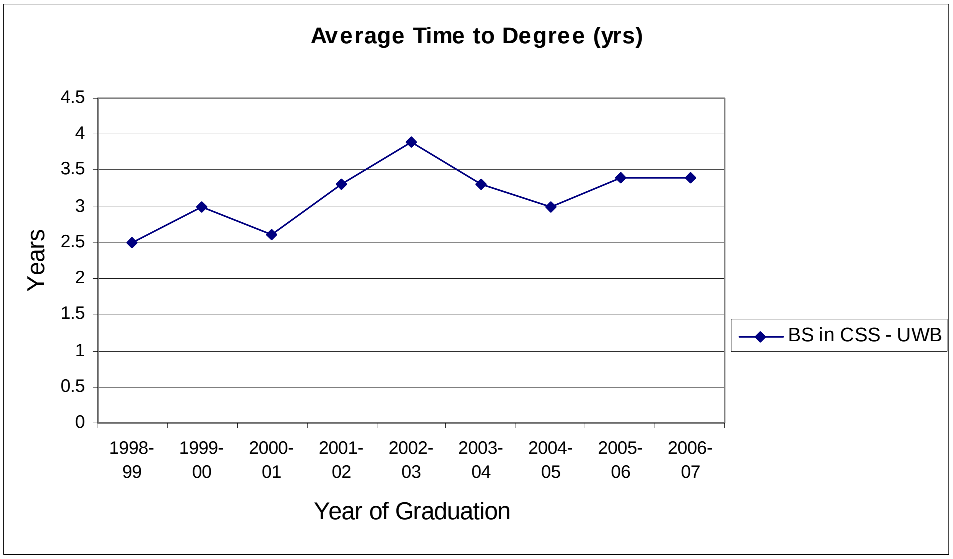
For comparison, in Table F.6 are shown the 2006-07 GEI data for several majors/colleges/campuses within the UW system. In each case the data reported is for the transfer students. In general, it is seen that the GEI for CSS-UWB exceeds that of all the comparison groups except "All UWB," which is the only group that does not consist primarily of science or engineering degrees. The largest group of students in "All UWB" is for the Interdisciplinary Arts and Science degree. It is not surprising that greater efficiency is achieved in an area without the more rigid prerequisite structure typical of a STEM curriculum.

Table F.6: UW Undergraduate Degree Efficiency Index for 2006-07

Campus Degree Program	Count	Average	Minimum	Maximum	Std. Dev.
UWB – CSS	51.0	85.8	15.2	100	16.4
UWT – CSS	44.0	79.2	45.0	100	15.4
College of Engr.	616.0	82.4	28.6	100.0	13.5
Coll. of A&S (BS only)	809.0	84.1	2.2	100.0	13.8
All UWB	553.0	88.2	0.0	100.0	16.5

Time to Degree is another mandated measure of "efficiency." This measure is reasonable in a setting of primarily full-time students (such as UWS), but is of only limited relevance in a population of largely part-time working students. Nonetheless, we examine the time to degree data for the last several years and see if there is any trend within the CSS student body. In Figure F.3, we see that the present time to degree for BSCSS students, presently at 3.4 years, has leveled off after a trend of increase in the early days of the program.

Figure F.3: Average time to Degree in years



Any interpretation of the time-to-degree data is fraught with uncertainty. The decrease since 2002 may well reflect the emphasis the program has placed on better preparation and selection of our entering transfer students. In fact, an overall time to degree of 3.4 years seems quite reasonable. A full-time transfer student with 100% efficiency would graduate in exactly 2.0 years. Our student body has many part-time students, and the average registration is approximately 10-11 credits per term, or 2/3 of full time. An enrollment pattern of 2/3 full time would translate into 3.0 academic years for the 100% efficient student.

For comparison Table F.7 presents the total credits, numbers of quarters registered, and time to degree for CSS and transfer students in other programs at UW. Indeed, the time to degree for CSS students is somewhat longer than for the other technical programs. The comparison with the non-technical programs ("All UWB") is not very relevant. The total number of credits earned by CSS students is the lowest on the table, reflecting the ease of articulation for transfer students and the high GEI of the program. The number of quarters taken on a part-time basis by CSS students is within the range of the comparison departments, as is the total number of quarters enrolled. The calendar year total is the only item on the table for which CSS students at UWB are outside of their comparison range. We believe that the reason for this is due to the nature of our Cooperative Education Project.

The ten-credit Cooperative Education (CE) Project (CSS 497) is *required* of all CSS students at UWB, a feature unique to the UWB degree. The vast majority (approx 80-85%) of students complete these projects *off campus* during their last quarters. Some complete the project in one term, and others take two. Because this major responsibility is elsewhere off campus, often many miles away, the students have a tendency to take a reduced load of courses along with CSS 497 during their CE quarters. This makes them effectively less full time toward the end of their program of study. In fact, it is not uncommon for CSS students to "stop out" for a quarter or two immediately after their CE project is begun, but before they actually graduate. This occurs because the students find they are able to achieve regular full-time employment at that stage of their education. They return at a later date to complete their degree and graduate.

Table F.7: Degrees Awarded by Level and Time to Degree for Transfer Student (Academic year 2006-2007)

Dept., College, Campus	Count	Total Credits	Av No of Quarters Enrolled			Ave time to degree in calendar years
			Full Time	Part Time	Total	
CSS	44	189.4	3.9	5.5	9.4	3.4
TCSS	42	195.0	4.9	4.0	8.9	3.1
CSE	45	204.4	2.3	7.5	9.8	3.1
COE	265	210.2	3.2	6.5	9.7	3.0
BS in Arts & Sci	1,710	201.8	4.6	4.4	9.1	3.1
All UWB	521	188.4	3.8	3.6	7.4	2.5

Evidence for this "stop out" phenomenon is found in Table F.7 in the difference between "Total quarters enrolled" and "calendar years to degree." For example, CSS UWB students are enrolled for 0.4 quarter less on average than are their peers in CSE (9.4 vs 9.8), but require *0.3 calendar year longer* to accomplish it (3.4 vs 3.1). This can only be accounted for by 1-2 quarters during which the CSS student is not enrolled, but only as a temporary "stop out" on the way to their degree. We would expect this condition to be less common in a program such as the BS in CSE that does not require the students to take working assignments off campus. This is not an inefficiency on the program's or students' parts, but represents the reality of well-trained students finding themselves in a very rewarding job market. This "stopping out" in fact can be viewed as a characteristic of having well prepared highly industrious students.

An interpretation that is in error would be that a somewhat longer "time to degree" is indicative of inefficiency in the curriculum or poor advising. The very high GEI discussed above is inconsistent with this interpretation, as is the relatively low total number of quarters enrolled prior to graduation.

4. BA in Applied Computing (BAAC)

Background

In recent years, it has become apparent that there is demand within the workforce for computer professionals trained with a focus on a specific application area. For example, a student might want to earn a Bachelor's degree in the application of computer science technology to areas such as bioinformatics, educational technology, business, health care informatics, scientific computing, etc. In a Sep 2005 report, David Patterson presented data showing the general growth in IT employment in the US since the minimum it reached in 2002.[14] By 2004, not only had total IT employment exceeded its former peak (in 2000), but the sector identified as "Computer Specialists" was the most rapidly expanding one. These computer specialists are computing professionals with a specialty in some particular application area.

[14] Patterson, David. *Communications of the ACM*, Sep 2005.

To meet this demand in this region, the CSS program proposed a new BAAC degree that was approved in 2007 and has enrolled its first students in Autumn 2007. The following quote from that proposal introduction gives the general philosophy of the BAAC degree and explains its distinguishing features:

> This Bachelor of Arts degree will be offered by the Computing and Software Systems (CSS) program to fill a regional community and industry need for well-educated computer science majors that have specialized knowledge across a wide range of knowledge domains (e.g., business, biotechnology, health sciences, education, the arts and other social/public service sectors).
>
> Given the shortage of baccalaureate programs in computing-related fields in the State of Washington, this program will provide opportunities for students that are interested in the application of computing technologies to specialty areas of their own choice.

Curriculum

The BAAC curriculum has a considerable overlap with that of the BSCSS degree discussed above. The full curriculum is presented in Appendix M, and some distinguishing features are discussed here. An overview is again provided by the BAAC proposal introduction:

> The design of our program is based on an innovative and interdisciplinary core curriculum that has been offered by UWB for over ten years. Fundamental differences between the proposed new AC degree and our existing Bachelor of Science in CSS include: 1) the requirement to complete a minor area of study (or approved discipline-specific course of study other than computing); 2) a new course that integrates hardware architecture and operating systems with a focus on application rather than theory; 3) a senior seminar course that requires students to conduct computing-related research within their minor area of study; and 4) reduced emphasis on computer science programming theory – and more emphasis on applying systems thinking to problems within their minor area of study. In addition, program prerequisites for the AC degree are slightly different in that only one course in Calculus in required; however, a general introductory course to computing has been added so that students understand how computing is used in society. Introductory courses of this type are widely offered within the community college system and within UWB's own first-year student courses.

Lower division preparation for the BAAC major includes 7 specific courses:

- composition and writing (2)
- introduction to computing (1)
- introductory CS1/CS2 computer programming (2)
- calculus (1)
- statistics (1)

Relative to the BSCSS degree, the set of core courses in the BA in AC has been reduced, from 8 to 5:

- Technical Writing for Computing Professionals (CSS 301)
- Mathematical Principles of Computing (CSS 342 or 263)
- Management Principles for Computing Professionals (CSS 350)
- Software Engineering (CSS 360)
- Hardware Architecture and Operating Systems (CSS 421)

The student complements this core with 7 courses (35 credits) of CSS electives and at least 25 credits in an “application area,” often in the form of a formal minor.

In addition, the BAAC student completes a 5-credit senior integrative exercise requiring computer-related research within their minor area. It is this capstone course that ties together the computing and the application area.

Overall, relative to the BS degree, the BA student has 10 credits that have been moved from the core to the CSS elective category, allowing further customization of the computer-related education to the needs of their application area. In the competency language of the BS degree, the BAAC students are able to select technical and specialty competencies that are germane to their application area.

Program Assessment

The success of the capstone integrative seminar projects will be utilized to determine the success of the overall BAAC philosophy and curriculum. The program will be considered successful if the students are able to effectively integrate their computer and application area knowledge in their final project. A secondary criterion will be the success of our BAAC students in securing employment upon graduation. The CSS staff will assist them in preparing for job searches and will remain in contact with them to follow up on their success after graduation. The other measures of program success, including graduation efficiency and time to degree data will be evaluated as experience is gained.

SECTION G –GRADUATE STUDENTS

At present there are no graduate students in the CSS program.

Upon launch of the MSCSS degree, we anticipate no difficulty in recruitment of qualified students. The CSS office staff receives electronic, phone, and in person inquiries about the program on a regular basis. A similar program at UWT has been successful in its recruitment, and we see no reason why the program at UWB could fail to do so. The MS program has been carefully planned with background courses to enhance student success, which should lead to good retention.

Adequate staff resources has been requested so that the MS students will receive high quality advising both from the program advisor and program faculty.