DOCUMENT RESUME

ED 449 313 CE 081 189

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TITLE	Occupational Supply and Demand in the State of Washington: Phase II Report.
INSTITUTION	Northwest Policy Center, Seattle, WA.
SPONS AGENCY	Washington State Board for Community and Technical Colleges, Olympia.
PUB DATE	2000-10-00
NOTE	58p.; This report is a refinement of the protocol presented in CE 081 188.
AVAILABLE FROM	For full text: http://www.workforceed.com/zPDFdocs/20_Resources/lmstudyfinal.pdf.
PUB TYPE	Numerical/Quantitative Data (110) -- Reports - Research (143)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Community Colleges; Computer Software; Curriculum Development; Definitions; Demand Occupations; Education Work Relationship; Educational Attainment; Educational Demand; *Educational Needs; Educational Opportunities; Educational Supply; Emerging Occupations; Employer Attitudes; Employment Level; Employment Opportunities; Employment Patterns; Employment Qualifications; Entry Workers; Futures (of Society); Graduates; Health Occupations; Income; Information Technology; Labor Force Development; Labor Market; *Labor Needs; *Labor Supply; Needs Assessment; Occupational Clusters; Postsecondary Education; Private Sector; Public Sector; Salary Wage Differentials; School Business Relationship; School Holding Power; Skilled Occupations; State Surveys; Statewide Planning; Strategic Planning; Tables (Data); *Technical Institutes; Technical Occupations; Technological Advancement; Trend Analysis; Two Year Colleges; *Vocational Education
IDENTIFIERS	Employer Surveys; Impact Studies; *Washington

ABSTRACT

Occupational supply and demand in Washington State was examined by comparing projected supplies of skilled workers coming out of the state's community and technical colleges against the projected demand among Washington employers for people qualified to enter particular occupations. The analysis was based on a January 2000 report, information gathered after publication of that report, a disaggregation of previous statewide estimates into Washington's 12 service delivery areas, and a survey of information technology (IT) work force needs that elicited 440 usable responses (a 24.6% response rate) from approximately 1,800 questionnaires mailed to Washington firms in May 2000. The following were among the main conclusions of the analysis: (1) the educational and training programs offered by Washington's community and technical colleges in many occupations, including computer-related and health occupations, merit expansion; (2) although demand outstrips the supply of graduates coming from community and technical colleges in the computer support cluster, many students exit after taking only a few courses; (3) the software industry's rapid growth is affecting nearly every major category of occupations and is creating substantial

additional demand in a wide range of college programs; and (4) IT-related fields face strong and growing demand from a diverse set of employers. (Contains 43 tables.) (MN)

Occupational Supply and Demand in the State of Washington

Phase II

Report for the State Board for Community and Technical Colleges
October 2000

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Executive Summary

This report provides a refinement of the labor market analysis protocol developed by the authors in a January 2000 report to the State Board for Community and Technical Colleges. That earlier report provided a statewide analysis of the gaps between the projected supply of skilled workers coming out of the state's community and technical colleges, and projected demand among Washington employers for people qualified to enter particular occupations. This report updates the information to include more recent data and dis-aggregates the statewide estimates into twelve Service Delivery Areas. In addition, Information Technology occupations are analysed in considerable detail, including a comparison of Computer Support occupations to related fields of study, development of a multiplier to show the impacts of software industry expansion on employers and occupations outside this sector, and a survey of Information Technology workforce demand outside the software industry.

The regional supply demand comparisons presented in this report demonstrate that there are many occupational areas that could be expanded because projected demand from employers substantially exceeds the supply coming out of the community and technical colleges. Computer-related and health occupations fall in this group in many of the regions. However, other sources of supply need to be evaluated before concluding that any particular community or technical college program can be expanded. Therefore, it is recommended that programs that are candidates for expansion be thoroughly investigated through additional analysis and conversations with local employers using the labor market study protocol presented in the January 2000 report. Another finding that emerges from the regional tables is that many of the occupations with substantial numbers of openings and large gaps between the projected demand and the supply trained by the colleges are in low wage occupations. It may not be economically defensible to create or expand programs aimed at meeting these employer demands. On-the-job training may be the best choice in these situations.

The three sections of the report focusing on Information Technology occupations have substantial implications for the community and technical colleges:

- Demand outstrips supply coming from the community and technical colleges in the Computer Support cluster. However, many students exit after taking only a few courses, and it is not clear how much they benefit from the courses they take, or if there is an opportunity to provide further education to these individuals. Little information is available about early leavers, who are a significant component of the overall output of these programs. Surveys or other expanded follow-up efforts are needed for fields in this cluster.
- The software industry has a very large multiplier of 5, according to a study for the Technology Alliance. When this multiplier is spread out across relevant industry categories based on the input-output model used to estimate the multipler, and then translated into occupational demand using Employment Security data, almost every major category of occupations is impacted. The rapid growth of this industry may be creating substantial additional demand in a wide range of college programs, and the colleges should monitor the growth of this industry in the future as part of

determining the overall level of demand for their vocational and professional programs.

- A survey of Information Technology workforce demand outside the software industry suggests that larger workplaces in Services and Government are anticipating substantial workforce expansion, requiring many additional IT workers. In addition, many smaller companies require enhanced IT skills even if they do not have dedicated IT specialists due to their size. It is likely that the IT programs in the colleges will see strong demand for their students outside, as well as inside the core IT industries.

Overall, these three sections indicate that the IT related fields of study in the Community and Technical Colleges face strong and growing demand from a diverse set of employers. The gap between employer demand and the supply of potential workers represented by the students in IT programs is not going to be eliminated without significant expansion by the colleges.

Introduction

This report provides a refinement of the labor market analysis protocol developed by the authors in a January 2000 report to the State Board for Community and Technical Colleges.[1] That earlier report provided an analysis of the gaps between the projected supply of skilled workers coming out of the state's community and technical colleges, and projected demand among Washington employers for people qualified to enter particular occupations. Our work on this topic is unique in that it focuses on the gaps between supply of trained workers and demand from employers at a detailed occupational level of analysis. Other reports examine this issue in the aggregate, perhaps breaking out both demand and supply by level of education and training, but not by occupational groupings.[2] This report extends our earlier analysis by disaggregating the statewide supply-demand occupational analysis into 12 substate regions called Service Delivery Areas (SDAs), most of which are multi-county regions. Both the supply of trained people leaving the community and technical colleges and the projected demand by occupation among employers is broken out at the SDA level in this report.

In addition, the gap between locally trained supply and employer demand has been particularly problematic in the Information Technology (IT) fields. This report attacks this issue in several ways:

- A special analysis of IT worker demand and supply by region, considering the level of educational program completion as a particularly important factor;
- A multiplier analysis showing the impact of software industry expansion on all other industries and the implications of the induced expansion of other industries on all occupations across the whole state economy; and
- A survey of a random sample of employers designed to estimate current and projected future demand for IT workers outside of the core IT sectors such as software development and electronic commerce.

Our January report also included labor market studies conducted by staff and faculty associated with several of the community and technical colleges. This report will be followed by another one in the fall of 2000 that will make final recommendations for the labor market analysis protocol for future use by the State Board and the colleges.

[1] Sommers, P. and Heg. D., *Matching Community and Technical College Professional/Technical Education Capacity to Employer Demand,* 1999. Phase I Report.

[2] Workforce Training and Education Coordinating Board, *Workforce Training: Supply, Demand and Gaps*, 1998.

Regional Demand-Supply Analysis

The methodology used in constructing the regional demand-supply analysis reported below is the same as reported in our January 2000 report. We screened the list of occupational projections as supplied by the Employment Security Department for those occupations in which the community and technical college system has a role in education and training. The community and technical colleges have become involved in training for specific occupations for a variety of reasons. One reason is that the level of education required to enter the occupation matches the capacity of the college system to provide a range of programs ranging from short term to one year certificates and two year degrees. Another reason is that local employers simply demand assistance, and these locally governed institutions have been eager to meet the needs of employers in their region. Our assumptions about which occupations to include have been reviewed by SBCTC staff, and a committee of vocational deans and other senior staff of the community and technical colleges.

It should be noted that there are a number of occupations included here that are formally categorized by the Bureau of Labor Statistics of the U.S. Department of Labor as requiring either a four-year degree or more, or, in contrast, very short term training (including on the job training). Using the education codes for each occupation supplied by the Washington State Employment Security Department (see box on page 4), most occupations requiring either "long" or "little" preparation were excluded. The relatively few "long" or "little" preparation occupations that are included are those for which the community and technical college system provides closely related or similar training, and we therefore felt they should be mentioned in this report. In some cases, this state's licensing requirements for certain health care fields permit workers to enter the field with a two-year technical degree rather than the four-year university degree required in many other states. However, these occupations with high and very low level education requirements are not included in any of the actual demand-supply gap estimates presented in this report since the community and technical college system is only part of the total supply system for these occupations. We do not have access to estimates of supplies coming from the universities or other sources at the high end, or from on-the-job or private training organizations at the low end. It would also be helpful to add high school and private career school job preparation program graduates to these numbers, but this is beyond the scope of this report at this time.

The regions used in this report are the state's 12 Service Delivery Areas (SDAs) defined in the box on page 4. The occupational projections for the years 1998 to 2008 were aggregated up from single county projections into the multi-county SDAs. Annual openings include openings due to both the creation of new jobs and the replacement of incumbent workers who are leaving their occupations.

Education Codes

1: Occupations requiring **long** preparation, generally four years or more of academic work leading to a bachelor's degree or higher and which may require work experience in addition to the degree.

2: Occupations requiring **moderate** preparation, generally for more than one year but less than four, which may be on the job, through employer or educational institution-provided instruction, or a combination. Jobs that require apprenticeships, certificates, diplomas, or associate's degrees are included here.

3: Occupations requiring **short** preparation, generally from one to 12 months, which may be on the job, employer or institution-provided, or a combination.

4: Occupations requiring **little** preparation, generally less than one month of training, usually obtained on the job.

(these codes are from a national survey of incumbent workers; some variability of educational requirements within occupations is inevitable)

Service Delivery Areas

SDA	Colleges	SDA Counties
1	Peninsula, most of Olympic	Clallam, Jefferson, Kitsap
2	Grays Harbor, Centralia, South Puget Sound and part of Olympic	Grays Harbor, Lewis, Mason, Pacific, Thurston
3	Whatcom, Bellingham, Skagit	Island, San Juan, Skagit, Whatcom
4	Everett, Edmonds, part of Shoreline, Cascadia and Lake Washington	Snohomish
5	Seattle District, Bellevue, Highline, Green River, Renton, and part of Shoreline, Cascadia and Lake Washington	King
6	Pierce, Tacoma, Bates, Clover Park	Pierce
7	Lower Columbia and most of Clark	Clark, Cowlitz, Skamania, Wahkiakum
8	Wenatchee and most of Big Bend	Adams, Chelan, Douglas, Grant, Okanogan
9	Yakima and small part of Clark	Kittitas, Klickitat, Yakima
10	Walla Walla and some of Spokane	Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Stevens, Walla Walla, Whitman
11	Columbia Basin	Benton, Franklin
12	Most of Spokane	Spokane

The usefulness of the SDA regions for a regional demand-supply analysis has been verified by analyses conducted by SBCTC staff using student completions data that link educational program completion information with employment outcomes. These data were made available to us by SBCTC and ESD, permitting sorting and aggregation of the individual student records into the 12 regions and detailed occupational categories. As explained in the Phase I Report on this project, these matches between occupational projections and program completions have some significant imperfections (for example, management projections are classified by industry sector, e.g., finance, personnel, services, greenhouse, etc., whereas program completions tend to focus on business management/entrepreneurism). Nevertheless, this approach of matching occupational projections to education program completions represents one of the few tools that currently can be used in attempts to compare supply and demand.

Note that the estimates of supply/demand gaps in this report are a first approximation, and factors not explicitly measured in this analysis may significantly modify the balance between supply and demand in a particular region. Three especially important factors are apprenticeships, net migration, and labor force participation rates.

Apprenticeships are not included in this report's completions list because the needed data were not available. If apprentices were included, some gaps between demand and supply would be reduced in size. In fact, many of the apparent gaps between supply and demand shown in tables later in this report are in the construction trades, precisely the type of occupations for which unions operate apprentice programs. The colleges sometimes play a role as a provider of training services within these programs.

This state tends to attract more new residents than it loses to other states or countries due to migration. An analysis of this issue by the Workforce Training and Education Coordinating Board concludes that the state gains baccalaureate and graduate degree workers through the process of migration, but that workers in the occupational fields requiring less than baccalaureate level education are much less likely to move across state lines in pursuit of a better job. For this reason, we have not attempted to estimate the impact of net migration on the several hundred separate occupations of interest in this report based on counts of the number of people moving into the state. In certain border regions such as Spokane and Vancouver, however, interstate migration may be a very strong factor.

Not every completer of a community college program enters the labor market even if they stay in the state. Thus, estimated supplies of completers could be reduced by estimates of labor force participation rates. However, these rates are likely to vary significantly from occupation to occupation, and region to region based on the strength of demand and other factors. Thus, no attempt is made in this report to adjust supply estimates for labor force participation.

The possible importance of these three factors, combined with the difficulty of creating reliable estimates of their impacts, leads to the recommendation that the supply/demand gap estimates presented below be treated as first approximations. As first approximations

on a difficult and complicated issue, these estimates should be buttressed by more detailed studies in each region based on interviews of employers, before any adjustments are made to program sizes by the colleges.

As in the Phase I report, computer occupations are combined into one cluster because of highly variable estimates of education requirements, potential employer demand, and rapidly changing occupational boundaries as new industries and new companies emerge from the rapid evolution of information technology. The associated wage reported for this cluster is a weighted median wage for these occupations statewide. All other wages are 1998 median wages for Washington State incumbent workers in a specific occupation; however, it should be kept in mind that wages are hourly, and there is no way to tell how many of the job openings are full versus part time.

The regional spreadsheets resulting from this work contain a good deal of confidential information on over 70 thousand students who exited the colleges' job preparation training programs during three academic years: 1995/96 through 1997/98. Some data on employment outcomes by occupation for these former students can be published at the state level within the confidentiality rules established by the state and federal governments. These rules require reporting only on those vocational fields with at least 25 individual records to protect the privacy of the individuals involved. No regional breakouts of this table are feasible given the confidentiality concerns.

The supply/demand comparisons do not provide a complete picture of all the issues involved in trying to close employment gaps. There are qualitative questions that must also be considered; for example, if a program were created to address an apparent supply gap, would employers make it worth the while of students to complete such programs? An even larger question concerns some of the underlying cultural values with respect to occupational choices here, particularly in the K-12 system, which tends to place a much higher value on university degrees than on vocational technical training. In addition, the lack of information about the real labor market helps to perpetuate a large gap between what students want to do and what jobs actually exist. All of these issues must be included in any programmatic decision making stemming from an analysis such as the one in this report.

Reading the Regional Tables

On the following pages are three tables for each of the 12 SDAs. Each SDA has the following tables:

1. A table of the 25 occupations with the largest demand-supply gaps at the education levels where the community and technical colleges traditionally train (education codes 2 and 3). The last two columns show the number of annual openings left over after all of the CTC completions in that area have been subtracted, and the overall proportion of demand being addressed by CTC supply. Both are ways to portray to what extent demand for that occupation is being met by the college system.

Note: Completions are defined as students who finished 45+ credits at 2.0+ GPA, certificates, degrees, and/or industry-ready special programs and industry certifications. The completions numbers in these tables represent the average of the three academic years included in the database, 1996-1998. This three-year average is being used for several reasons: first, to smooth out year to year fluctuations that do not represent deliberate changes in program size; and second, because the OES projections are actually for a 10-year period, from which annual openings are derived simply by dividing by 10, with no attempt to apportion differently throughout the decade based on expected economic events; therefore, the more smoothing out over time, the more accurate the match between completions and projections may be. The only occupations for which this is NOT the case are those within information technology and construction. Both industries have seen as much as 20% annual increases in CTC training slots over the last few years; thus, the single most recent year of training would show notably more completers than the previous year or two.

2. The second table for each region shows the non-CTC level occupations for which the region's CTCs are providing training. These are occupations that are coded as requiring either longer (four years or more) or shorter (less than one month) training levels than are typically provided by the CTC system. The last two columns show the number of completions as defined above, and the total number of students who took any credits in that area. Although students with fewer than 45 credits are not counted as being completers, they still may be of significant interest in the labor market (see report section on information technology students).

3. A table of the 25 occupations with the highest numbers of projected annual openings in that region, to provide an overall context for economic behavior in the region by occupation.

The complete regional spreadsheets are available from the SBCTC for analysts who want to conduct additional research.

With a few exceptions that will be noted below, the overall patterns of occupational demand and supply are actually fairly similar for all regions of the state.

Patterns in Highest Demand-Supply Gaps

The main point of this table is to give the reader useful information on specific training opportunities in each region that are not being fully exploited by its CTCs. Virtually all regions have a significant number of higher-paying occupations where they are either not training at all or could increase the number of seats in order to meet a demand that is currently higher than supply. While some of these occupations have broad titles that are difficult to define in concrete curricula (e.g., miscellaneous Management Support Workers), the demand-supply gaps for many other occupations that appear in this table could be addressed with relative ease. These include occupations for which skill and training requirements are already well-defined and easily implemented. For example, training could be readily added or increased in occupations such as secretary, auto mechanic, heavy truck driver, bookkeeping/accounting clerk, carpenters, painters, electricians, and certain sales positions.

While the tables may be useful as a first approximation in identifying occupations that the colleges could focus more resources on, it is also apparent from a quick scan of the tables that this information needs to be used in combination with other information about particular occupations and both student and employer needs. For example, in 11 of 12 regional demand-supply tables below, cashiers are listed as one of the occupations with a substantial gap between demand and supply coming from the colleges. Pierce County has the only college offering a program in this field, even though the occupation is coded as requiring "short preparation," i.e., one to twelve months of training. It is an occupation with a low median wage, just barely above minimum wage. In most regions, employers are evidently providing the one to twelve months of training on-the-job or through private trainers; however, in Pierce County a different choice has been made, perhaps in response to unique student or employers needs. Another example of the need to supplement these demand and supply comparisons is the prevalence of construction trades in the largest gap tables in a number of regions. Training in the construction trades is often carried out in apprentice programs operated by unions in collaboration with groups of employers. Colleges sometimes play a role in delivering classroom- or shop-based training as part of an apprentice program, but in all cases much of the training is provided on-the-job. Since this mainly on-the-job system is not providing sufficient trained workers, as the various regional tables demonstrate, there is room to expand the relevant programs. As noted above, no data on the volume of trainees in apprentice programs was available as this report was being prepared; this information would have to be assembled and analysed before concluding that there are substantial gaps in these fields. Certain health care occupations such as licensed practical nurses and dental hygienists show up on several of the regional demand-supply gap tables. Two additional types of information are needed in interpreting these apparent gaps: licensing requirements, and the role universities play in training students in these health care fields.

Patterns in CTC Training for High and Low Education Occupations

This table allows the reader to see the occupations in which each region is training where education/training requirements are either higher or lower than the CTC system typically provides. These are occupations where training is more typically provided by four year colleges, private career schools, or private employers. For various reasons, the community and technical colleges also offer programs in these fields:

- real or perceived employer demand,
- opportunity to fill niche market needs no other provider has filled (e.g., hair styling for particular ethnic groups with unique requirements),
- specific employer requests,
- overall value of the sector to the region,
- social value of the occupation (e.g., child care),
- lack of available alternative providers (in rural regions the publicly supported community college may be the only readily available post-secondary educational institution), or
- other reasons which may merit further study by the region.

The trend throughout the regions in this table is the provision of training in certain low wage, low skill occupations. It also appears to be the case for some regions that training is being provided in occupations with relatively high wages and skills but low local demand. In these cases, a college may be responding to demand in other nearby regions. An example of this is Walla Walla's partnership with the John Deere Company to train agricultural equipment mechanics for a broad multi-state region. The overall purpose of this table is to allow regions to examine why and to what extent they are training at either end of the education requirements spectrum and whether there is compelling reason to continue such training.

Patterns in Highest Annual Openings

The third table for each region, Highest Number of Openings, shows the 25 occupations with the highest numbers of projected annual openings at all education levels. This table is simply intended to provide the user with a clear view of which occupations in the region have the highest demand, as a way of scanning expected job growth in their local economy. In virtually all regions, the occupations at the very top of the table are typically low wage, e.g., retail salespersons, cashiers, food preparation workers. The

high demand, higher wage occupations usually appear lower down in these tables, with notably fewer annual openings than the top occupations. Often, the low wage occupations are experiencing both high growth and rapid turnover, while the higher wage occupations are growing slowly but offer more stable, longer-term replacement job openings as current job holders retire, move to other occupations, or leave the area. It should be noted that one region, SDA 9, has notably more low wage occupations throughout the entire table, with only six of the 25 paying $11.00 or more an hour. The other regions typically have 10-15 occupations in this pay range. The other exception to the pattern is Region 4, which presents a contrasting picture; 17 out of the 25 occupations in that region's table pay $11.00+/hour.

It should be noted that a number of occupational titles end with the label "miscellaneous." When an occupation exists in large numbers over a long period, it is specifically identified. For example, in the overall category of science technicians, there are titles for biological and chemical science technicians. For the remaining variety of science technicians, which may cover a wide range of work but exist in smaller numbers, there is a "science technicians, misc." title. This miscellaneous title (also known as NEC, or Not Elsewhere Classified) can be an important repository of information and is often where emerging occupations are included until the occupational classification system is updated to include new titles. For example, webmasters are reportedly counted in a miscellaneous artists category. Therefore, although it is difficult if not impossible to associate most of these miscellaneous occupational titles with specific educational programs, we have chosen to leave them in the tables because of the important role they play in the labor market overall.

Region 1: Clallam, Jefferson, Kitsap Counties

Region 1, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment 1998	Projected Annual Openings	Demand -Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	2,918	186	186.0	0%
Carpenters	2	$17.95	2,405	72	64.3	11%
Computer Support Cluster*	variable	$19.72	1,187	103	48.3	53%
Truck Drivers, Heavy	3	$14.35	1,380	41	41.0	0%
Secretaries, Ex Legal or Med	2	$11.28	1,783	42	37.3	11%
Painters & Paperhangers	3	$14.06	1,130	37	37.0	0%
Cooks, Restaurant	2	$8.24	937	49	35.0	29%
Plumbers/Pipefittrs/Steamfitrs	2	$18.93	1,498	35	34.3	2%
Teacher Aides, Paraprof	2	$9.37	894	37	33.7	9%
Dental Assistants	2	$12.32	443	31	31.0	0%
Electricians	2	$20.05	1,149	27	27.0	0%
Automotive Mechanics	2	$14.12	1,150	60	26.7	56%
Prof, Paraprof, Techns, misc.*	2	$16.25	766	25	25.0	0%
Correction Officers	2	$15.52	396	23	23.0	0%
Licensed Practical Nurses	2	$13.11	438	22	21.3	3%
Hairdressers & Hairstylists	2	$6.78	595	21	17.3	17%
Police Patrol Officers	2	$20.48	319	18	17.0	6%
Sales Representatives, misc.	3	$17.03	348	16	16.0	0%
Sales & Related Workrs	3	$13.20	368	16	16.0	0%
Dental Hygienists	2	$29.18	186	16	16.0	0%
Personal/Home Care Aides	2	$10.55	153	16	16.0	0%
Automotive Body Repairers	2	$14.48	300	16	16.0	0%
Salespersons, Parts	3	$11.53	329	15	15.0	0%
Bakers, Bread & Pastry	2	$8.48	244	15	15.0	0%
Registered Nurses	2	$19.87	1,616	68	14.7	78%

Region 1, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Mgmt Support Workers, misc.	1	$16.17	380	8	50.7	112.7
Child Care Workers	4	$6.78	1,514	78	32.3	86.3
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	450	16	8.0	11.0
Salespersons, Retail	4	$7.88	4,557	239	7.3	13.0
General Office Clerks	4	$9.73	2,436	91	2.0	3.3
Timber Cutting Workers, misc.	4	$14.74	10	0	1.0	15.3

Region 1—education levels 1 + 4:
Total openings=1,996

Total completions=322

Region 1, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	4,557	239
Comb Food Prep/Serv Wkrs	4	$5.51	2,584	201
Cashiers	3	$7.33	2,918	186
Waiters & Waitresses	4	$5.43	2,070	144
Food Preparation Workers	4	$6.90	1,326	114
Computer Support Cluster*	variable	$19.72	1,187	103
General Office Clerks	4	$9.73	2,436	91
Child Care Workers	4	$6.78	1,514	78
Carpenters	2	$17.95	2,405	72
Registered Nurses	2	$19.87	1,616	68
Janitors & Cleaners	4	$8.13	1,807	64
Maintenance Repairers, Gen Util	4	$12.17	1,395	61
Automotive Mechanics	2	$14.12	1,150	60
Nursing Aides & Orderlies	4	$8.12	1,202	54
Reception/Information Clks	4	$8.90	1,157	52
Cooks, Restaurant	2	$8.24	937	49
Bookkpng, Accntng, Audit Clks	3	$11.06	2,762	48
Laborers, Landscp/Groundskeep	4	$9.74	901	43
Clerical Supervisors	2	$13.38	974	43
Secretaries, Ex Legal or Med	2	$11.28	1,783	42
Truck Drivers, Heavy	3	$14.35	1,380	41
Fishers/Hunters/Trappers	4	n/a	663	40
Truck Drivers, Light	4	$9.46	997	38
Teacher Aides, Paraprof	2	$9.37	894	37
Painters & Paperhangers	3	$14.06	1,130	37

Region 2: Grays Harbor, Lewis, Mason, Pacific, Thurston Counties

Region 2, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment 1998	Projected Annual Openings	Demand -Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	4,259	260	260.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	4,851	224	224.0	0%
Truck Drivers, Heavy	3	$14.35	2,960	88	87.0	1%
Teacher Aides, Paraprof	2	$9.37	2,397	85	82.3	3%
Carpenters	2	$17.95	2,458	80	68.7	14%
Secretaries, Ex Legal or Med	2	$11.28	2,791	65	53.7	17%
Cooks, Restaurant	2	$8.24	1,312	62	52.7	15%
Service Workers, misc.	2	$8.51	998	42	42.0	0%
Registered Nurses	2	$19.87	2,171	74	38.0	49%
Correction Officers	2	$15.52	609	35	33.0	6%
Painters & Paperhangers	3	$14.06	656	32	32.0	0%
Hairdressers & Hairstylists	2	$6.78	861	32	30.3	5%
Personnel/Train/Lab Rel Specs	2	$15.38	503	30	30.0	0%
Automotive Mechanics	2	$14.12	1,263	64	29.3	54%
Sales Representatives, misc.	3	$17.03	714	26	26.0	0%
Medical Assistants	2	$9.93	381	37	23.0	38%
Instructors & Coaches, Sports	3	$11.03	713	22	22.0	0%
Salespersons, Parts	3	$11.53	473	22	22.0	0%
Dental Hygienists	2	$29.18	249	21	21.0	0%
Automotive Body Repairers	2	$14.48	378	21	21.0	0%
Cooks, Institution/Cafe	2	$9.28	508	20	20.0	0%
Drywall Installers	3	$20.64	348	19	19.0	0%
Police Patrol Officers	2	$20.48	501	29	17.3	40%
Instructors, Adult (Non-VocEd)	2	$14.46	758	16	16.0	0%

Region 2, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Mgmt Support Workers, misc.	1	$16.17	460	16	31.3	66.3
Child Care Workers	4	$6.78	1,643	85	21.0	46.7
Forest & Conservation Wkrs	4	$10.81	465	15	10.3	27.0
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	923	35	10.0	18.7
Timber Cutting Workers, misc.	4	$14.74	210	6	6.0	9.3
Reception/Information Clks	4	$8.90	1,599	84	4.7	9.3
Nursing Aides & Orderlies	4	$8.12	1,361	53	0.7	2.7
Salespersons, Retail	4	$7.88	5,393	280	0.3	0.3
Janitors & Cleaners	4	$8.13	2,401	87	0.3	0.3

Guards	4	$7.87	383	14	0.3	1.0
Aquatic Life Cultivation Workers	4	n/a	273	7	0.3	0.7
Veterinary Assistants	4	$7.24	40	1	0.3	0.3

Region 2-ed level 1 + 4
Total openings=2,605
Total completions=183

Region 2, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	5,393	280
Cashiers	3	$7.33	4,259	260
Prof, Paraprof, Techns, misc.	2	$16.25	4,851	224
Waiters & Waitresses	4	$5.43	2,986	201
General Office Clerks	4	$9.73	4,092	151
Food Preparation Workers	4	$6.90	1,911	151
Comb Food Prep/Serv Wkrs	4	$5.51	2,049	147
Computer Support Cluster*	variable	$19.72	1,646	140
Truck Drivers, Heavy	3	$14.35	2,960	88
Janitors & Cleaners	4	$8.13	2,401	87
Teacher Aides, Paraprof	2	$9.37	2,397	85
Child Care Workers	4	$6.78	1,643	85
Reception/Information Clks	4	$8.90	1,599	84
Carpenters	2	$17.95	2,458	80
Maintenance Repairers, Gen Util	4	$12.17	1,948	77
Registered Nurses	2	$19.87	2,171	74
Clerical Supervisors	2	$13.38	1,553	68
Secretaries, Ex Legal or Med	2	$11.28	2,791	65
Bookkpng, Accntng, Audit Clks	3	$11.06	3,385	64
Automotive Mechanics	2	$14.12	1,263	64
Cooks, Restaurant	2	$8.24	1,312	62
Laborers, Landscp/Groundskeep	4	$9.74	1,591	54
Nursing Aides & Orderlies	4	$8.12	1,361	53
Log Handling Eqp Oprs	4	$14.99	1,368	51
Bartenders	4	$6.90	1,043	48

Region 3: Island, San Juan, Skagit, Whatcom Counties

Region 3, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand -Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	3,887	249	248.3	0%
Carpenters	2	$17.95	3,517	115	115.0	0%
Truck Drivers, Heavy	3	$14.35	2,316	89	57.7	35%
Bookkpng, Accntng, Audit Clks	3	$11.06	3,982	75	56.3	25%
Secretaries, Ex Legal or Med	2	$11.28	2,055	52	52.0	0%
Cooks, Restaurant	2	$8.24	1,326	69	47.7	31%
Painters & Paperhangers	3	$14.06	822	39	39.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	652	36	36.0	0%
Automotive Mechanics	2	$14.12	1,082	53	35.7	33%
Sales Representatives, misc.	3	$17.03	768	31	31.0	0%
Teacher Aides, Paraprof	2	$9.37	1,206	46	28.7	38%
Electricians	2	$20.05	1,209	37	28.7	23%
Cooks, Institution/Cafe	2	$9.28	589	28	28.0	0%
Hairdressers & Hairstylists	2	$6.78	799	28	28.0	0%
Instructors & Coaches, Sports	3	$11.03	705	26	26.0	0%
Teachers & Instructors, VocED	2	$20.84	659	24	24.0	0%
Bakers, Bread & Pastry	2	$8.48	476	28	23.7	15%
Police Patrol Officers	2	$20.48	351	22	14.3	35%
Salespersons, Parts	3	$11.53	421	21	21.0	0%
Instructors, Adult (Non-VocEd)	2	$14.46	700	21	21.0	0%
Plumbers/Pipefittrs/Steamfitrs	2	$18.93	619	21	21.0	0%
Automotive Body Repairers	2	$14.48	381	25	19.0	24%
Dental Hygienists	2	$29.18	209	18	18.0	0%
Operating Engineers	3	$19.27	389	17	17.0	0%
Emergency Medical Technicians	2	$11.15	216	16	15.7	2%

Region 3, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Nursing Aides & Orderlies	4	$8.12	1,086	39	64.0	89.7
Mgmt Support Workers, misc.	1	$16.17	360	16	19.3	44.7
Veterinary Assistants	4	$7.24	42	0	16.7	22.7
Artists/Commercial Artists	1	$11.40	449	21	14.0	19.3
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	791	27	13.0	18.3
Child Care Workers	4	$6.78	2,101	91	8.7	25.0
Forest & Conservation	4	$10.81	126	4	5.7	11.7

Wkrs						
General Office Clerks	4	$9.73	3,217	124	1.3	2.7
Billing, Cost/Rate Clerks	4	$10.88	280	12	1.3	1.3
Reception/Information Clks	4	$8.90	1,439	72	0.7	0.7
Recreation Workers	1	$8.44	347	22	0.3	0.3
Aquatic Life Cultivation Workers	4	n/a	59	1	0.3	0.3
Salespersons, Retail	4	$7.88	6,230	298	0.3	0.3
Architects, Ex Lndscpe & Marine	1	$19.86	80	4	0.3	0.3

Region 3:--ed level 1 + 4
Total openings=2,537
Total completions=295

Region 3, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	6,230	298
Cashiers	3	$7.33	3,887	249
Waiters & Waitresses	4	$5.43	2,824	199
Comb Food Prep/Serv Wkrs	4	$5.51	2,179	166
General Office Clerks	4	$9.73	3,217	124
Food Preparation Workers	4	$6.90	1,393	117
Carpenters	2	$17.95	3,517	115
Child Care Workers	4	$6.78	2,101	91
Truck Drivers, Heavy	3	$14.35	2,316	89
Maintenance Repairers, Gen Util	4	$12.17	1,941	77
Bookkpng, Accntng, Audit Clks	3	$11.06	3,982	75
Janitors & Cleaners	4	$8.13	2,271	73
Reception/Information Clks	4	$8.90	1,439	72
Cooks, Restaurant	2	$8.24	1,326	69
Farm Wkrs, Food & Fiber Crops	4	$6.37	2,352	68
Counter Attendants, Lunchrm	4	$5.70	613	61
Personal/Home Care Aides	4	$7.97	517	54
Automotive Mechanics	2	$14.12	1,082	53
Registered Nurses	2	$19.87	1,816	52
Secretaries, Ex Legal or Med	2	$11.28	2,055	52
Clerical Supervisors	2	$13.38	1,150	51
Computer Support Cluster*	variable	$19.72	534	49
Laborers, Landscp/Groundskeep	4	$9.74	1,119	48
Teacher Aides, Paraprof	2	$9.37	1,206	46
Assemb & Fabricatrs, misc.	4	$9.43	974	41

Region 4: Snohomish County

Region 4, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	4,817	346	346.0	0%
Computer Cluster*	variable	$19.72	5139	259	173.3	33%
Carpenters	2	$17.95	4,676	157	157.0	0%
Automotive Mechanics	2	$14.12	2,228	108	95.3	12%
Painters & Paperhangers	3	$14.06	1,695	94	94.0	0%
Cooks, Restaurant	2	$8.24	1,541	81	71.7	12%
Sales Representatives, misc.	3	$17.03	1,746	70	70.0	0%
Truck Drivers, Heavy	3	$14.35	2,326	69	69.0	0%
Teacher Aides, Paraprof	2	$9.37	1,907	73	68.3	6%
Hairdressers & Hairstylists	2	$6.78	2,012	90	65.3	27%
Electricians	2	$20.05	1,675	58	58.0	0%
Instructors & Coaches, Sports	3	$11.03	928	57	57.0	0%
Electrical/Electronic Eq Assemblrs, Prec	2	$9.03	1,412	57	57.0	0%
Bartenders	4	$6.90	1,012	52	52.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	1,424	51	51.0	0%
Sales & Related Workrs	3	$13.20	1,149	58	50.3	13%
Secretaries, Ex Legal or Med	2	$11.28	3,477	69	46.3	33%
Machinists	2	$14.63	1,744	45	45.0	0%
Correction Officers	2	$15.52	714	44	44.0	0%
Dental Assistants	2	$12.32	629	43	43.0	0%
Fire Fighters	2	$19.41	688	41	41.0	0%
Aircraft Struct Assemblers, Prec	2	$17.53	1,785	35	35.0	0%
Telemktrs, Door-To-Door Sales	3	$7.95	871	33	33.0	0%
Dental Hygienists	2	$29.18	399	33	33.0	0%
Purch Agts, Ex Who/Ret/Farm	2	$14.94	1,073	30	30.0	0%

Region 4, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Child Care Workers	4	$6.78	2,764	145	60.0	115.3
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	421	20	50.7	87.0
Mgmt Support Workers, misc.	1	$16.17	3,183	63	47.3	108.7
General Office Clerks	4	$9.73	5,765	160	5.7	9.0

Salespersons, Retail	4	$7.88	8,424	468	4.3	7.7
Artists/Commercial Artists	1	$11.40	750	37	3.3	8.3
Nursing Aides & Orderlies	4	$8.12	1,620	74	2.7	18.0
Real Estate Appraisers	1	$21.57	166	4	0.3	0.3

Region 4:--ed level 1 + 4
Total openings=3,680
Total completions=684

Region 4, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	8,424	468
Cashiers	3	$7.33	4,817	346
Comb Food Prep/Serv Wkrs	4	$5.51	3,634	278
Computer Cluster*	variable	$19.72	5,139	259
Waiters & Waitresses	4	$5.43	3,467	251
Food Preparation Workers	4	$6.90	2,211	193
General Office Clerks	4	$9.73	5,765	160
Carpenters	2	$17.95	4,676	157
Child Care Workers	4	$6.78	2,764	145
Reception/Information Clks	4	$8.90	2,245	109
Automotive Mechanics	2	$14.12	2,228	108
Janitors & Cleaners	4	$8.13	3,007	102
Painters & Paperhangers	3	$14.06	1,695	94
Hairdressers & Hairstylists	2	$6.78	2,012	90
Clerical Supervisors	2	$13.38	1,953	86
Maintenance Repairers, Gen Util	4	$12.17	1,852	84
Bookkpng, Accntng, Audit Clks	3	$11.06	4,613	83
Registered Nurses	2	$19.87	2,418	82
Cooks, Restaurant	2	$8.24	1,541	81
Nursing Aides & Orderlies	4	$8.12	1,620	74
Truck Drivers, Light	4	$9.46	1,978	74
Teacher Aides, Paraprof	2	$9.37	1,907	73
Sales Representatives, misc.	3	$17.03	1,746	70
Secretaries, Ex Legal or Med	2	$11.28	3,477	69

Region 5: King County

Region 5, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Computer Support Cluster	variable	$19.72	25,359	2,411	2,105.7	13%
Cashiers	3	$7.33	21,340	1,329	1,329.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	10,480	544	544.0	0%
Sales Representatives, misc.	3	$17.03	14,924	528	528.0	0%
Clerical Supervisors	2	$13.38	13,097	584	480.7	18%
Secretaries, Ex Legal or Med	2	$11.28	21,546	462	447.0	3%
Sales Reps, Science	3	$20.67	8,302	397	397.0	0%
Carpenters	2	$17.95	13,980	409	386.7	5%
Telemktrs, Door-To-Door Sales	3	$7.95	6,330	294	294.0	0%
Health Prof/Paraprof/Techns, misc.	2	$15.76	5,758	281	277.0	1%
Flight Attendants	2	$17.85	4,214	269	269.0	0%
Sales & Related Workrs	3	$13.20	5,948	279	257.7	8%
Truck Drivers, Heavy	3	$14.35	10,033	262	250.3	4%
Electricians	2	$20.05	6,349	214	213.3	0%
Registered Nurses	2	$19.87	15,765	400	206.3	48%
Sales Agents, Business	3	$14.71	4,482	201	201.0	0%
Automotive Mechanics	2	$14.12	6,546	337	197.0	42%
Service Workers, misc.	2	$8.51	4,028	185	185.0	0%
Bookkpng, Accntng, Audit Clks	3	$11.06	24,402	410	183.0	55%
Painters & Paperhangers	3	$14.06	5,460	182	182.0	0%
Instructors & Coaches, Sports	3	$11.03	2,724	177	177.0	0%
Cooks, Restaurant	2	$8.24	6,152	311	167.7	46%
Personnel/Train/Lab Rel Specs	2	$15.38	4,079	195	164.7	16%
Police Patrol Officers	2	$20.48	2,520	176	161.0	9%
Salespersons, Parts	3	$11.53	3,066	137	129.0	6%

Region 5, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 median wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Artists/Commercial Artists	1	$11.40	4,421	234	150.0	223.3
Management Support Workers, misc.	1	$16.17	11,080	302	117.0	268.0
Child Care Workers	4	$6.78	7,013	246	99.0	269.3
Nursing Aides & Orderlies	4	$8.12	7,705	257	97.0	142.3
Salespersons, Retail	4	$7.88	39,086	1,916	64.0	145.7
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	1,288	66	58.0	121.7

General Office Clerks	4	$9.73	33,053	1,006	50.7	91.3

Region 5, CTC Training in Occupations with High or Low Education Requirements (continued)

Occupation Title	Education Required	1998 median wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Teacher Aides/Education Assts	4	$8.46	3,128	84	45.3	91.0
Interior Designers	1	$11.75	1,225	69	40.0	55.3
Library Assists/Bookmobile	4	$9.27	533	39	26.0	35.3
Electrical/Electronic Assemb	4	$9.09	1,040	47	24.7	31.7
Bank Tellers	4	$8.27	3,384	160	21.0	21.3
Med/Clin Lab Technologists	1	$17.22	1,519	69	20.3	24.0
Timber Cutting Workers, misc.	4	$14.74	15	0	7.0	16.7
Janitors & Cleaners	4	$8.13	13,919	436	6.0	7.0
Waiters & Waitresses	4	$5.43	15,320	1,078	5.0	6.0
Aircraft Pilots/Flight Engrs	1	$33.51	1,895	71	4.7	14.3
Recreation Workers	1	$8.44	1,412	100	4.3	7.7
Reception/Information Clks	4	$8.90	15,005	708	4.3	9.0
Real Estate Appraisers	1	$21.57	797	22	1.7	4.7
Home Health Aides	4	$7.81	5,516	207	0.3	0.3
Advertising Clerks	4	$10.12	173	5	0.3	0.3

Region 5--ed level 1 + 4
Total openings=16,835
Total completions=1,709

Region 5, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Computer Support Cluster	variable	$19.72	25,359	2,411
Salespersons, Retail	4	$7.88	39,086	1,916
Comb Food Prep/Serv Wkrs	4	$5.51	19,109	1,412
Cashiers	3	$7.33	21,340	1,329
Waiters & Waitresses	4	$5.43	15,320	1,078
General Office Clerks	4	$9.73	33,053	1,006
Food Preparation Workers	4	$6.90	8,871	722
Reception/Information Clks	4	$8.90	15,005	708
Clerical Supervisors	2	$13.38	13,097	584
Prof, Paraprof, Techns, misc.	2	$16.25	10,480	544
Sales Representatives, misc.	3	$17.03	14,924	528

Secretaries, Ex Legal or Med	2	$11.28	21,546	462
Janitors & Cleaners	4	$8.13	13,919	436
Counter Attendants, Lunchrm	4	$5.70	4,475	426
Bookkpng, Accntng, Audit Clks	3	$11.06	24,402	410
Carpenters	2	$17.95	13,980	409
Maintenance Repairers, Gen Util	4	$12.17	9,652	407
Registered Nurses	2	$19.87	15,765	400
Truck Drivers, Light	4	$9.46	11,460	400
Sales Reps, Science	3	$20.67	8,302	397
Automotive Mechanics	2	$14.12	6,546	337
Guards	4	$7.87	6,953	334
Cooks, Restaurant	2	$8.24	6,152	311
Designers, Ex Interior	1	$13.79	5,308	303
Management Support Workers, misc.	1	$16.17	11,080	302

Region 6: Pierce County

Region 6, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	6,241	359	319.3	11%
Carpenters	2	$17.95	3,949	111	111.0	0%
Registered Nurses	2	$19.87	4,252	151	108.3	28%
Clerical Supervisors	2	$13.38	2,669	117	100.7	14%
Cooks, Restaurant	2	$8.24	1,883	103	88.7	14%
Prof, Paraprof, Techns, misc.	2	$16.25	1,869	82	82.0	0%
Automotive Mechanics	2	$14.12	2,364	125	76.3	39%
Secretaries, Ex Legal or Med	2	$11.28	4,326	104	70.7	32%
Sales Representatives, misc.	3	$17.03	2,519	84	64.0	24%
Teacher Aides, Paraprof	2	$9.37	2,296	82	56.7	31%
Instructors & Coaches, Sports	3	$11.03	1,043	54	54.0	0%
Correction Officers	2	$15.52	794	53	53.0	0%
Police Patrol Officers	2	$20.48	738	47	7.0	15%
Electricians	2	$20.05	1,788	48	44.3	8%
Health Prof/Paraprof/Techns, misc.	2	$15.76	1,449	44	44.0	0%
Painters & Paperhangers	3	$14.06	1,180	41	41.0	0%
Teachers & Instructors, VocED	2	$20.84	1,156	39	39.0	0%
Instructors, Adult (Non-VocEd)	2	$14.46	1,267	37	37.0	0%
Cooks, Institution/Cafe	2	$9.28	840	35	35.0	0%
Telemktrs, Door-To-Door Sales	3	$7.95	1,103	30	30.0	0%
Sales & Related Workrs	3	$13.20	1,354	61	29.7	51%
Electrical/Electronic Eq Assemblrs, Prec	2	$9.03	359	29	29.0	0%
Drywall Installers	3	$20.64	509	26	26.0	0%
Salespersons, Parts	3	$11.53	955	40	23.3	42%
Personnel/Train/Lab Rel Specs	2	$15.38	472	25	22.0	12%

Region 6, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Mgmt Support Workers, misc.	1	$16.17	579	637	92.3	190.7
Child Care Workers	4	$6.78	2,851	3,937	44.7	96.3
General Office Clerks	4	$9.73	6,139	6,760	35.3	48.0
Artists/Commercial Artists	1	$11.40	646	844	28.7	42.7
Nursing Aides & Orderlies	4	$8.12	2,544	3,345	22.7	26.7
Agric,Forest,Fishng	4	$9.09	930	1,054	21.0	28.3

Wkrs,misc.						
Designers, Ex Interior	1	$13.79	628	783	19.0	27.0
Protect Service Occs, misc.	4	$12.49	306	360	17.3	20.3
Reception/Information Clks	4	$8.90	2,669	3,419	16.7	20.3
Architects, Ex Lndscpe & Marine	1	$19.86	377	406	14.3	24.0
Interior Designers	1	$11.75	168	187	14.0	21.7
Med/Clin Lab Technologists	1	$17.22	300	378	10.3	14.7
Travel Clerks	4	$8.35	16	16	10.0	13.3
Home Health Aides	4	$7.81	2,264	2,916	7.7	10.7
Aircraft Pilots/Flight Engrs	1	$33.51	25	29	6.3	15.0
Library Assists/Bookmobile	4	$9.27	281	348	5.3	10.0
Recreation Workers	1	$8.44	644	812	1.3	1.3
Curatrs/Archiv/Museum Techs	1	$5.64	32	41	0.7	2.0
Janitors & Cleaners	4	$8.13	4,586	5,458	0.3	4.0

Region 6 --ed level 1 + 4
Total openings=4,244
Total completions=779

Region 6, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	10,183	463
Cashiers	3	$7.33	6,241	359
Waiters & Waitresses	4	$5.43	4,572	346
Comb Food Prep/Serv Wkrs	4	$5.51	4,269	330
Food Preparation Workers	4	$6.90	2,666	213
General Office Clerks	4	$9.73	6,139	202
Janitors & Cleaners	4	$8.13	4,586	180
Registered Nurses	2	$19.87	4,252	151
Child Care Workers	4	$6.78	2,851	141
Maintenance Repairers, Gen Util	4	$12.17	3,199	134
Truck Drivers, Heavy	3	$14.35	4,497	132
Automotive Mechanics	2	$14.12	2,364	125
Reception/Information Clks	4	$8.90	2,669	124
Clerical Supervisors	2	$13.38	2,669	117
Nursing Aides & Orderlies	4	$8.12	2,544	114
Carpenters	2	$17.95	3,949	111
Computer Cluster*	variable	$19.72	1,439	109
Secretaries, Ex Legal or Med	2	$11.28	4,326	104
Cooks, Restaurant	2	$8.24	1,883	103
Social Workers, Med & Psyc	1	$15.17	1,573	98
Home Health Aides	4	$7.81	2,264	96
Bookkpng, Accntng, Audit Clks	3	$11.06	5,710	96
Hairdressers & Hairstylists	2	$6.78	2,291	95
Truck Drivers, Light	4	$9.46	2,468	92
Licensed Practical Nurses	2	$13.11	2,018	86

Region 7, Clark, Cowlitz, Skamania, Wahkiakum Counties

Region 7, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	3,789	259	259.0	0%
Truck Drivers, Heavy	3	$14.35	3,385	142	142.0	0%
Computer Support Cluster*	variable	$19.72	1,405	141	107.7	24%
Carpenters	2	$17.95	2,985	106	106.0	0%
Teacher Aides, Paraprof	2	$9.37	1,720	87	86.7	0%
Secretaries, Ex Legal or Med	2	$11.28	2,923	85	85.0	0%
Sales Representatives, misc.	3	$17.03	1,442	66	63.3	4%
Hairdressers & Hairstylists	2	$6.78	1,316	56	56.0	0%
Painters & Paperhangers	3	$14.06	1,014	54	54.0	0%
Electricians	2	$20.05	1,272	50	49.7	1%
Slaughterers & Butchers	2	$9.22	33	47	47.0	0%
Bookkpng, Accntng, Audit Clks	3	$11.06	3,433	72	42.0	42%
Automotive Mechanics	2	$14.12	1,225	65	42.0	35%
Machinery Mechanics, misc.	2	$17.75	755	41	41.0	0%
Dental Assistants	2	$12.32	490	40	40.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	967	39	39.0	0%
Clerical Supervisors	2	$13.38	1,405	65	38.7	41%
Plumbers/Pipefittrs/Steamfitrs	2	$18.93	980	36	36.0	0%
Electrical/Electronic Assemblrs	2	$9.03	1,341	36	36.0	0%
Cooks, Restaurant	2	$8.24	1,070	65	35.7	45%
Carpet Installers	3	$17.15	604	34	34.0	0%
Roofers	3	$14.38	605	32	32.0	0%
Sales & Related Workrs	3	$13.20	699	31	31.0	0%
Heat, A/C, Refrig Mechanics	2	$14.48	455	28	28.0	0%
Automotive Body Repairers	2	$14.48	517	32	27.0	16%

Region 7, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Mgmt Support Workers, misc.	1	$16.17	591	19	31.7	95.0
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	319	15	25.7	49.3
Child Care Workers	4	$6.78	1,300	77	20.7	45.7
Nursing Aides & Orderlies	4	$8.12	1,192	60	33.7	35.3
Artists/Commercial Artists	1	$11.40	170	8	13.0	33.7
Protect Service Occs, misc.	4	$12.49	107	9	6.7	20.7
General Office Clerks	4	$9.73	3,725	142	3.3	15.7
Reception/Information Clks	4	$8.90	1,755	92	4.0	13.3
Salespersons, Retail	4	$7.88	5,852	338	1.7	3.7
Bank Tellers	4	$8.27	846	41	1.0	3.3
Library Assists/Bookmobile	4	$9.27	112	9	0.3	0.3

Region 7:--ed level 1 + 4
Total openings=11,281
Total completions=1,670

Region 7, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	5,852	338
Cashiers	3	$7.33	3,789	259
Comb Food Prep/Serv Wkrs	4	$5.51	2,927	249
Waiters & Waitresses	4	$5.43	2,642	210
Food Preparation Workers	4	$6.90	1,686	158
General Office Clerks	4	$9.73	3,725	142
Truck Drivers, Heavy	3	$14.35	3,385	142
Computer Support Cluster*	variable	$19.72	1,405	141
Janitors & Cleaners	4	$8.13	2,458	111
Carpenters	2	$17.95	2,985	106
Reception/Information Clks	4	$8.90	1,755	92
Home Health Aides	4	$7.81	1,421	92
Teacher Aides, Paraprof	2	$9.37	1,720	87
Registered Nurses	2	$19.87	2,189	86
Maintenance Repairers, Gen Util	4	$12.17	1,850	86
Secretaries, Ex Legal or Med	2	$11.28	2,923	85
Child Care Workers	4	$6.78	1,300	77
Bookkpng, Accntng, Audit Clks	3	$11.06	3,433	72
Sales Representatives, misc.	3	$17.03	1,442	66
Clerical Supervisors	2	$13.38	1,405	65
Cooks, Restaurant	2	$8.24	1,070	65
Automotive Mechanics	2	$14.12	1,225	65
Nursing Aides & Orderlies	4	$8.12	1,192	60
Bartenders	4	$6.90	1,016	59
Hairdressers & Hairstylists	2	$6.78	1,316	56

Region 8: Adams, Chelan, Douglas, Grant, Okonogan Counties

Region 8, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	2,599	167	167.0	0%
Truck Drivers, Heavy	3	$14.35	2,271	77	69.0	10%
Teacher Aides, Paraprof	2	$9.37	1,225	47	41.0	13%
Secretaries, Ex Legal or Med	2	$11.28	1,316	37	37.0	0%
Carpenters	2	$17.95	1,413	43	36.3	16%
Instructors & Coaches, Sports	3	$11.03	509	32	32.0	0%
First Line Superv: Ag,Forest,Fis	2	$15.61	1,242	32	32.0	0%
Cooks, Restaurant	2	$8.24	711	31	31.0	0%
Hairdressers & Hairstylists	2	$9.44	461	29	29.0	0%
Medical Assistants	2	$9.93	235	26	22.0	15%
Bookkpng, Accntng, Audit Clks	3	$11.06	2,182	43	20.7	52%
Sprayers/Applicators	3	$12.15	809	20	20.0	0%
Machinery Mechanics, misc.	2	$17.75	472	24	20.0	17%
Police Patrol Officers	2	$20.48	321	20	20.0	0%
Dental Assistants	2	$12.32	246	19	19.0	0%
Welders & Cutters	2	$12.97	197	23	18.7	19%
Emergency Medical Technicians	2	$11.15	257	18	18.0	0%
Salespersons, Parts	3	$11.53	293	17	17.0	0%
Machinists	2	$14.63	212	17	17.0	0%
Sales Representatives, misc.	3	$17.03	366	16	16.0	0%
Carpet Installers	3	$17.15	218	16	16.0	0%
Electricians	2	$20.05	456	15	15.0	0%
Automotive Mechanics	2	$14.12	637	33	14.7	56%
Production Inspectors, Graders	2	$10.99	465	14	14.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	329	13	13.0	0%

Region 8, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Aircraft Pilots/Flight Engrs	1	$33.51	53	3	27.3	34.0
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	1088	35	18.0	51.3
Med/Clin Lab Technologists	1	$17.22	73	5	14.0	16.0
Salespersons, Retail	4	$7.88	2894	162	2.7	4.3
Mgmt Support Workers, misc.	1	$16.17	145	6	1.7	13.3
Child Care Workers	4	$6.78	650	41	0.7	6.7
Nursing Aides & Orderlies	4	$8.12	786	27	0.3	38.3

Region 8, CTC Training in Occupations with High or Low Education Requirements (continued)
Region 8--ed level 1 + 4
Total openings=2,078
Total completions=164

Region 8, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Farm Wkrs, Food & Fiber Crops	4	$6.37	14,752	450
Cashiers	3	$7.33	2,599	167
Salespersons, Retail	4	$7.88	2,894	162
Waiters & Waitresses	4	$5.43	1,626	108
Comb Food Prep/Serv Wkrs	4	$5.51	1,385	98
Truck Drivers, Heavy	3	$14.35	2,271	77
General Office Clerks	4	$9.73	1,740	71
Food Preparation Workers	4	$6.90	899	69
Graders/Sorters, Ag Product	4	$7.01	2,236	68
Farm Equipment Operators	4	$9.81	2,251	68
Maintenance Repairers, Gen Util	4	$12.17	1,485	62
Janitors & Cleaners	4	$8.13	1,413	50
Teacher Aides, Paraprof	2	$9.37	1,225	47
Registered Nurses	2	$19.87	1,241	47
Clerical Supervisors	2	$13.38	944	43
Bookkpng, Accntng, Audit Clks	3	$11.06	2,182	43
Carpenters	2	$17.95	1,413	43
Industrial Truck & Tractor Ops	4	$10.85	1,140	43
Child Care Workers	4	$6.78	650	41
Reception/Information Clks	4	$8.90	734	38
Secretaries, Ex Legal or Med	2	$11.28	1,316	37
Pruners	4	$11.61	1,325	36
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	1,088	35
Automotive Mechanics	2	$14.12	637	33
Instructors & Coaches, Sports	3	$11.03	509	32

Region 9: Kittitas, Klickitat, Yakima Counties

Region 9, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	3003	163	163.0	0%
Truck Drivers, Heavy	3	$14.35	2365	80	80.0	0%
Carpenters	2	$17.95	1862	50	50.0	0%
Secretaries, Ex Legal or Med	2	$11.28	1615	35	34.3	2%
Bookkpng, Accntng, Audit Clks	3	$11.06	2713	47	33.0	30%
Instructors & Coaches, Sports	3	$11.03	513	30	30.0	0%
Cooks, Restaurant	2	$8.24	610	26	26.0	0%
Teacher Aides, Paraprof	2	$9.37	1416	44	25.7	42%
Clerical Supervisors	2	$13.38	952	36	25.3	30%
First Line Superv: Ag,Forest,Fis	2	$15.61	934	23	23.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	456	22	22.0	0%
Medical Assistants	2	$9.93	206	21	21.0	0%
Welders & Cutters	2	$12.97	372	20	20.0	0%
Automotive Mechanics	2	$14.12	714	30	19.0	37%
Cooks, Institution/Cafe	2	$9.28	517	19	19.0	0%
Dental Assistants	2	$12.32	304	19	18.7	2%
Licensed Practical Nurses	2	$13.11	496	22	17.0	23%
Police Patrol Officers	2	$20.48	306	17	17.0	0%
Hairdressers & Hairstylists	2	$6.78	527	17	17.0	0%
Sales Representatives, misc.	3	$17.03	516	16	16.0	0%
Salespersons, Parts	3	$11.53	341	15	15.0	0%
Machinery Mechanics, misc.	2	$17.75	370	14	14.0	0%
Painters & Paperhangers	3	$14.06	308	14	14.0	0%
Operating Engineers	3	$19.27	226	12	12.0	0%
Teachers & Instructors, VocED	2	$20.84	442	11	11.0	0%

Region 9, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Mgmt Support Workers, misc.	1	$16.17	200	9	23.7	40.3
Child Care Workers	4	$6.78	1,323	58	13.3	4.3
Animal Breeders	1	$11.97	2	0	2.7	4.3
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	1,783	55	2.0	4.3
Nursing Aides & Orderlies	4	$8.12	1,221	55	0.7	57.3
Artists/Commercial Artists	1	$11.40	92	2	0.3	2.7

Region 9--ed level 1 + 4
Total openings=2,134
Total completions=183

Region 9, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Farm Wkrs, Food & Fiber Crops	4	$6.37	13,973	389
Cashiers	3	$7.33	3,003	163
Salespersons, Retail	4	$7.88	2,968	142
Waiters & Waitresses	4	$5.43	1,650	102
Comb Food Prep/Serv Wkrs	4	$5.51	1,339	89
General Office Clerks	4	$9.73	2,391	81
Truck Drivers, Heavy	3	$14.35	2,365	80
Graders/Sorters, Ag Product	4	$7.01	2,668	65
Food Preparation Workers	4	$6.90	843	63
Child Care Workers	4	$6.78	1,323	58
Nursing Aides & Orderlies	4	$8.12	1,221	55
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	1,783	55
Registered Nurses	2	$19.87	1,634	54
Maintenance Repairers, Gen Util	4	$12.17	1,364	54
Carpenters	2	$17.95	1,862	50
Bookkpng, Accntng, Audit Clks	3	$11.06	2,713	47
Janitors & Cleaners	4	$8.13	1,584	45
Teacher Aides, Paraprof	2	$9.37	1,416	44
Reception/Information Clks	4	$8.90	987	44
Farm Equipment Operators	4	$9.81	1,465	43
Home Health Aides	4	$7.81	920	42
Counter Attendants, Lunchrm	4	$5.70	418	40
Farm Wkrs,Farm/Ranch Animals	4	$7.78	1,439	40
Laborers, Landscp/Groundskeep	4	$9.74	1,012	39
Personal/Home Care Aides	4	$7.97	335	37

Region 10: Asotin, Columbia, Ferry, Garfield, Lincoln, Pend Oreille, Stevens, Walla Walla, Whitman Counties

Region 10, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	1,751	104	104.0	0%
Carpenters	2	$17.95	1,075	48	44.3	8%
Truck Drivers, Heavy	3	$14.35	1,382	44	42.3	4%
Secretaries, Ex Legal or Med	2	$11.28	1,425	39	39.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	741	31	31.0	0%
Correction Officers	2	$15.52	622	29	24.3	16%
Science Technicians, misc.	2	$19.22	528	21	17.7	16%
Instructors, Adult (Non-VocEd)	2	$14.46	338	16	16.0	0%
Instructors & Coaches, Sports	3	$11.03	338	16	16.0	0%
Teacher Aides, Paraprof	2	$9.37	650	20	15.0	25%
Cooks, Restaurant	2	$8.24	450	16	14.3	10%
Clerical Supervisors	2	$13.38	704	28	13.3	52%
Automotive Mechanics	2	$14.12	509	25	12.3	51%
Cooks, Institution/Cafe	2	$9.28	373	12	12.0	0%
Electricians	2	$20.05	373	11	11.0	0%
Painters & Paperhangers	3	$14.06	284	11	11.0	0%
Police Patrol Officers	2	$20.48	242	13	10.3	21%
Farm Equipment Mechanics	2	$11.00	410	10	10.0	0%
Welders & Cutters	2	$12.97	251	13	9.7	26%
Fire Fighters	2	$19.41	197	10	9.7	3%
Athletes, Coaches, Umpires	2	$9.40	167	9	9.0	0%
Sales Representatives, misc.	3	$17.03	227	9	9.0	0%
Salespersons, Parts	3	$11.53	183	9	9.0	0%
Carpet Installers	3	$17.15	117	9	9.0	0%
Health Prof/Paraprof/Techns, misc.	2	$15.76	297	10	8.7	13%

Region 10, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Farm Equipment Operators	4	$9.81	722	20	35.7	47.7
Mgmt Support Workers, misc.	1	$16.17	341	12	27.7	54.3
Agric,Forest,Fishng Wkrs, misc	4	$9.09	428	18	18.3	2.7
General Office Clerks	4	$9.73	1,586	62	6.3	0.7
Child Care Workers	4	$6.78	968	57	4.0	1.7
Artists/Commercial Artists	1	$11.40	137	8	2.0	1.0
Library Assists/Bookmobile	4	$9.27	157	10	1.7	10.0
Recreation Workers	1	$8.44	87	5	1.0	1.3
Timber Cutting Workers, misc.	4	$14.74	9	0	1.0	1.3
Nursing Aides & Orderlies	4	$8.12	927	26	0.7	0.3
Forest & Conservation Wkrs	4	$10.81	280	9	0.7	32.0
Interior Designers	1	$11.75	34	2	0.3	0.3
Recreational Therapists	1	$15.79	20	1	0.3	76.3

Region 10--ed level 1 + 4
Total openings=1,157
Total completions=236

Region 10, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Cashiers	3	$7.33	1,751	104
Salespersons, Retail	4	$7.88	1,845	91
Farm Wkrs, Food & Fiber Crops	4	$6.37	2,450	69
Comb Food Prep/Serv Wkrs	4	$5.51	1,034	66
Janitors & Cleaners	4	$8.13	1,574	57
Waiters & Waitresses	4	$5.43	924	56
Food Preparation Workers	4	$6.90	800	56
General Office Clerks	4	$9.73	1,586	62
Child Care Workers	4	$6.78	968	57
Carpenters	2	$17.95	1,075	48
Truck Drivers, Heavy	3	$14.35	1,382	44
Secretaries, Ex Legal or Med	2	$11.28	1,425	39
Maintenance Repairers, Gen Util	4	$12.17	1,117	39
Prof, Paraprof, Techns, misc.	2	$16.25	741	31
Meat, Poultry, Fish Cutters	4	$8.52	732	29
Nursing Aides & Orderlies	4	$8.12	927	26
Correction Officers	2	$15.52	622	29

Laborers, Landscp/Groundskeep	4	$9.74	554	21
Reception/Information Clks	4	$8.90	467	20
Log Handling Eqp Oprs	4	$14.99	471	19
Counter Attendants, Lunchrm	4	$5.70	197	18
Truck Drivers, Light	4	$9.46	560	18
Science Technicians, misc.	2	$19.22	528	21
Instructors, Adult (Non-VocEd)	2	$14.46	338	16
Instructors & Coaches, Sports	3	$11.03	338	16

Region 11, Benton, Franklin Counties

Region 11, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	1,682	99	99.0	0%
Secretaries, Ex Legal or Med	2	$11.28	2,181	38	38.0	0%
Teacher Aides, Paraprof	2	$9.37	1,008	37	37.0	0%
Truck Drivers, Heavy	3	$14.35	1,113	33	33.0	0%
Carpenters	2	$17.95	1,103	32	25.0	22%
Bookkpng, Accntng, Audit Clks	3	$11.06	1,466	28	23.0	18%
Carpet Installers	3	$17.15	290	22	22.0	0%
Automotive Mechanics	2	$14.12	601	29	19.3	33%
Prof, Paraprof, Techns, misc.	2	$16.25	404	19	19.0	0%
Plant & System Occs, misc.	2	$10.21	551	19	19.0	0%
Dental Assistants	2	$12.32	226	18	18.0	0%
Medical Assistants	2	$9.93	163	18	18.0	0%
Hairdressers & Hairstylists	2	$6.78	360	18	18.0	0%
Sales Representatives, misc.	3	$17.03	441	17	17.0	0%
Painters & Paperhangers	3	$14.06	405	17	17.0	0%
Machinery Mechanics, misc.	2	$17.75	358	16	16.0	0%
Salespersons, Parts	3	$11.53	287	15	15.0	0%
Medical Secretaries	2	$9.67	239	14	14.0	0%
Electricians	2	$20.05	558	14	14.0	0%
Police Patrol Officers	2	$20.48	208	12	12.0	0%
Automotive Body Repairers	2	$14.48	225	16	11.0	31%
Cooks, Restaurant	2	$8.24	378	11	11.0	0%
Cooks, Institution/Cafe	2	$9.28	241	10	10.0	0%
First Line Superv: Ag,Forest,Fis	2	$15.61	413	10	10.0	0%
Correction Officers	2	$15.52	148	10	9.7	3%

Region 11, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	578	24	8.0	15.3
Child Care Workers	4	$6.78	771	36	7.7	41.0
Mgmt Support Workers, misc.	1	$16.17	1,381	36	5.7	7.0
General Office Clerks	4	$9.73	2,138	52	0.3	0.3

Region 11--ed level 1 + 4
Total openings=1,234
Total completions=113

Region 11, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Farm Wkrs, Food & Fiber Crops	4	$6.37	6,572	183
Salespersons, Retail	4	$7.88	2,847	150
Cashiers	3	$7.33	1,682	99
Comb Food Prep/Serv Wkrs	4	$5.51	1,284	68
Waiters & Waitresses	4	$5.43	1,065	54
General Office Clerks	4	$9.73	2,138	52
Food Preparation Workers	4	$6.90	584	39
Secretaries, Ex Legal or Med	2	$11.28	2,181	38
Computer Cluster*	variable	$19.72	721	37
Teacher Aides, Paraprof	2	$9.37	1,008	37
Mgmt Support Workers, misc.	1	$16.17	1,381	36
Child Care Workers	4	$6.78	771	36
Registered Nurses	2	$19.87	1,093	35
Reception/Information Clks	4	$8.90	868	34
Maintenance Repairers, Gen Util	4	$12.17	981	33
Truck Drivers, Heavy	3	$14.35	1,113	33
Janitors & Cleaners	4	$8.13	1,044	32
Carpenters	2	$17.95	1,103	32
Automotive Mechanics	2	$14.12	601	29
Bookkpng, Accntng, Audit Clks	3	$11.06	1,466	28
Farm Equipment Operators	4	$9.81	939	26
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	578	24
Clerical Supervisors	2	$13.38	543	23
Industrial Truck & Tractor Ops	4	$10.85	557	23
Carpet Installers	3	$17.15	290	22

Region 12: Spokane County

Region 12, Highest Demand-Supply Gaps, CTC Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Demand-Supply Gap	Completions as % of Annual Openings
Cashiers	3	$7.33	4,636	276	276.0	0%
Truck Drivers, Heavy	3	$14.35	3,189	100	100.0	0%
Sales Representatives, misc.	3	$17.03	2,444	82	82.0	0%
Secretaries, Ex Legal or Med	2	$11.28	3,649	72	71.0	1%
Computer Support Specialists*	variable	$19.72	1,476	91	70.3	23%
Clerical Supervisors	2	$13.38	2,127	87	67.7	22%
Registered Nurses	2	$19.87	3,949	122	55.0	55%
Teacher Aides, Paraprof	2	$22.38	1,419	55	55.0	0%
Cooks, Restaurant	2	$8.24	1,477	68	48.7	28%
Carpenters	2	$17.95	2,819	57	42.7	25%
Medical Assistants	2	$9.93	459	42	42.0	0%
Bookkpng, Accntng, Audit Clks	3	$11.06	4,284	72	41.3	43%
Electricians	2	$20.05	1,234	41	41.0	0%
Prof, Paraprof, Techns, misc.	2	$16.25	975	39	39.0	0%
Painters & Paperhangers	3	$14.06	786	33	33.0	0%
Automotive Mechanics	2	$14.12	1,541	67	30.3	55%
Telemktrs, Door-To-Door Sales	3	$7.95	908	29	29.0	0%
Roofers	3	$14.38	510	29	29.0	0%
Dental Hygienists	2	$29.18	383	28	28.0	0%
Cooks, Institution/Cafe	2	$9.28	645	28	28.0	0%
Demos, Promoters, Models	3	n/a	628	28	28.0	0%
Insur Adjusters, Examiners	2	$19.57	597	24	24.0	0%
Salespersons, Parts	3	$11.53	602	26	23.0	12%
Licensed Practical Nurses	2	$13.11	1021	30	22.3	26%
Sales Reps, Science	3	$20.67	635	22	22.0	0%

Region 12, CTC Training in Occupations with High or Low Education Requirements

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings	Completions (Average across 95-98)	All Job Preparation Program students
Mgmt Support Workers, misc.	1	$16.17	491	15	59.7	19.3
General Office Clerks	4	$9.73	4,641	137	44.0	7.0
Agric,Forest,Fishng Wkrs, misc.	4	$9.09	201	8	42.7	20.3
Artists/Commercial Artists	1	$11.40	394	21	40.7	20.3
Child Care Workers	4	$6.78	2,732	119	30.7	10.0
Interior Designers	1	$11.75	164	9	16.0	5.3
Library Assists/Bookmobile	4	$9.27	202	12	14.3	4.7

Personal/Home Care Aides	4	$7.97	641	44	9.0	3.3
Recreation Workers	1	$8.44	278	19	7.3	0.3
Forest & Conservation Wkrs	4	$10.81	11	0	5.0	2.3
Salespersons, Retail	4	$7.88	6,880	307	4.7	1.7
Timber Cutting Workers, misc.	4	$14.17	1	0	4.7	2.0
Bank Tellers	4	$8.27	919	41	1.0	0.3
Recreational Therapists	1	$15.79	55	4	0.7	0.3
Protect Service Occs, misc.	4	$12.49	510	46	0.7	0.3

Region 12--ed level 1 + 4
Total openings=2,973
Total completions=529

Region 12, Highest Number of Openings, All Education Levels

Occupation Title	Education Required	1998 Median Wage	Total Employment, 1998	Projected Annual Openings
Salespersons, Retail	4	$7.88	6,880	307
Cashiers	3	$7.33	4,636	276
Waiters & Waitresses	4	$5.43	3,154	208
Comb Food Prep/Serv Wkrs	4	$5.51	2,856	197
Food Preparation Workers	4	$6.90	1,857	139
General Office Clerks	4	$9.73	4,641	137
Registered Nurses	2	$19.87	3,949	122
Child Care Workers	4	$6.78	2,732	119
Janitors & Cleaners	4	$15.32	3,845	113
Truck Drivers, Heavy	3	$14.35	3,189	100
Reception/Information Clks	4	$8.90	2,181	92
Computer Support Specialists*	variable	$19.72	1,476	91
Clerical Supervisors	2	$13.38	2,127	87
Sales Representatives, misc.	3	$17.03	2,444	82
Nursing Aides & Orderlies	4	$8.12	2,126	80
Maintenance Repairers, Gen Util	4	$12.17	2,110	77
Counter Attendants, Lunchrm	4	$5.70	742	72
Secretaries, Ex Legal or Med	2	$11.28	3,649	72
Bookkpng, Accntng, Audit Clks	3	$11.06	4,284	72
Cooks, Fast Food	4	$5.60	1,342	70
Cooks, Restaurant	2	$8.24	1,477	68
Automotive Mechanics	2	$14.12	1,541	67
Truck Drivers, Light	4	$9.46	1,906	60
Carpenters	2	$17.95	2,819	57
Bartenders	4	$6.90	1,253	56

The Computer Support Cluster

Assessing the balance of employer demand and the supply of trained potential workers leaving community and technical colleges is particularly problematic in the case of computer related occupations. There are several issues that must be considered. First, some occupations in this cluster can be entered successfully with a two year community college degree, a one year certificate, or a few courses and a practical demonstration of skill. These occupations include many software application program users, as well as data and information processing, technical support, and programming. Other computer related occupations are sometimes filled successfully by people with less than a baccalaureate degree, but employers often say that they prefer candidates with a baccalaureate degree for such occupations as software developers, systems analysts, and technical program managers. These employers want candidates for these jobs to have both technical skills and a wide range of exposure to different disciplines and ways of thinking. Many employers assume that these skills are more likely to be found in job candidates with a university degree rather than a community college degree or certificate. Pointing out that Microsoft's chairman is the highest paid college dropout in the world does not change the criteria applied in the human resource offices of software companies and internet businesses. Due to this employer interest in broadly educated individuals who also have specific technical skills, many students who already have college degrees and significant work experience are enrolling in community college courses to gain technical skills in computer related fields. Such students may not be interested in completing either degree or certificate requirements. Other students may be attracted into these programs by the very strong job market created by rapid growth of software and internet-related firms. However, many of these fields require strong mathematical skills and other skills that some students may not have. Consequently, some students leave computer-related programs early having decided that they are not interested or qualified to successfully complete a certificate or degree. These factors require a very broad interpretation of successful completion standards, and attention to labor market data including wages to interpret the apparent gap between supply and demand.

Another critical issue is that federal government agencies have created two rather different classification systems, one for occupations that state agencies are required to use in constructing occupational forecasts, and one for education programs that state agencies are required to use when reporting education program outcomes in order to secure federal funding for these programs. When a field is changing rapidly due to technological progress, the mismatch between these two classification systems is very problematic. Examining the list of education programs in the table below, it is clear that Washington's community and technical colleges are rapidly adapting to the demand from employers for new fields of study such as multimedia technicians and client server specialists. On the occupational side, the classification system has not adapted as quickly. The two occupations just mentioned probably get associated with "All Other Computer Scientists," an aggregated occupational code that does not convey much useful information to employers or jobseekers. As mentioned earlier, webmasters have been lumped into "All Other Artists," an occupational category far removed from the world of computers and software. As a consequence, we decided to aggregate all computer

support occupations together in the regional tables on both the occupational and educational sides, and to provide a more disaggregated look at each side of the market in this section.

Table 1 shows the number of community and technical college students who exited from a variety of computer support/software development fields from fall 1995 to June 1998; the number of those completers employed in Washington, Oregon, Idaho, Montana, and the federal government in the third quarter after exiting; and the median earnings for the latter group (bearing in mind that, for confidentiality reasons, employment numbers below 25 could not be reported). An important fact emerges from a scrutiny of this table—the issue of the adequacy of supply coming from the community and technical colleges depends on how much education one really needs to be successful in this field. Almost half of students exiting from fields in the Computer Support cluster were classified as "early leavers," having completed less than 45 credits. On the other hand, 57% percent of the exiting students had been to college before enrolling at their current college, and half of those already had degrees or certificates, including some bachelors' or higher degrees. Ninety-five of the exiting students transferred to a 4-year college or university; although their fields of study are unknown; 4-year institutions may be a likely destination for computer programming students since a majority of software industry employers prefer a bachelor's degree for new hires.[3] It should be noted that self-employment is not included in these numbers, and for information technology this could be a significant source of post-college work.

Table I – Employment Outcomes for IT Cluster Early Leavers/Completers

CIP Code/Program Name		Early Leavers (3-44 credits, or <2.0 GPA)	Completers (45+ credits and 2.0+ GPA)	Total	% Completers	Completers' earnings as % of Early Leavers' earnings
110298	All Exiting	99	140	239	59%	
COMPUTER PROGRAMMING	In Covered Employment	63	110	173	64%	
	Median Wage	$10.03	$13.42			134%
110301	All Exiting	1,460	1,199	2,659	45%	
DATA PROCESSING	In Covered Employment	1,034	934	1,968	47%	
	Median Wage	$12.12	$13.36			110%

(continued on next page)

[3] Sommers, P, *Washington State Software Industry Challenges*, Report for the Washington Software Alliance, October 20, 1998, p. 23.

Table I – Employment Outcomes for IT Cluster Early Leavers/Completers (continued)

CIP Code/Program Name		Early Leavers (3-44 credits, or <2.0 GPA)	Completers (45+ credits and 2.0+ GPA)	Total	% Completers	Completers' earnings as % of Early Leavers' earnings
110401	All Exiting	390	316	706	45%	
INFORMATION PROCESSING	In Covered Employment	255	232	487	48%	
	Median Wage	$11.17	$12.18			109%
119995	All Exiting	125	69	194	36%	
MULTIMEDIA TECHNICIAN	In Covered Employment	83	54	137	39%	
	Median Wage	$10.41	$13.20			127%
119996	All Exiting	73	57	130	44%	
COMPUTER CLIENT SERVER SPC	In Covered Employment	47	52	99	53%	
	Median Wage	$14.81	$18.33			124%
119998	All Exiting	610	574	1,184	48%	
MICROCOMPUTER APPLICATIONS	In Covered Employment	416	405	821	49%	
	Median Wage	$10.55	$11.72			111%
150301	All Exiting	71	63	134	47%	
COMPUTER TECHNOLOGY	In Covered Employment	48	48	96	50%	
	Median Wage	$10.92	$15.12			138%
150402	All Exiting	236	626	862	73%	
COMPUTER SERVICE TECH	In Covered Employment	162	512	674	76%	
	Median Wage	$9.98	$12.77			128%
151196	All Exiting	35	30	65	46%	
GEOGRAPHIC INFO SYSTEMS	In Covered Employment	24	23	47	49%	
	Median Wage	Ns too small for reporting				
470193	All Exiting	71	233	304	77%	
DATA COMMUNICATIONS TECH	In Covered Employment	52	190	242	79%	
	Median Wage	$14.28	$14.57			102%

470198	All Exiting	34	89	123	72%	
MICRO-COMPUTER TECH	In Covered Employment	23	65	88	74%	
	Median Wage		$15.22 Ns too small for reporting			
Grand Total	All Exiting	3,204	3,396	6,600	51%	
Info Tech	In Covered Employment	2,207	2,625	4,832	54%	
	Median Wage	$11.39	$13.18			116%

Source: SBCTC based on the Participant Outcomes Data Consortium (PODC) protocols for linking college and Washington Employment Security Department records plus similar records from other states.

However, consider the employment outcomes associated with the various educational completion levels by scanning across any row of the table. The percentage of students who completed their program before leaving ranges from 36 to 72 percent across the various fields of study depicted in Table 1. The percent of students who subsequently found a job in Washington or nearby ranges from 26 to 79 percent. Wages of completers are higher than those of early leavers, but the wage differential realized by completers ranges from 9 to 34 percent over the early leavers' wage level. These variations confirm that completing a program is likely to yield a higher wage level; however, the diverse backgrounds of students in this cluster means that many early leavers will realize wage benefits from their studies. For this cluster, the employment outcomes do not warrant dropping the early leavers when comparing demand to locally educated supply. However, so many early exits take place that it may be wise to consider the demand–supply balance in two ways, once with these early leavers included and a second time with them excluded.

Now consider Table 2, which provides the data for each SDA, and offers comparisons between projected demand over any three-year period between 1998-2008, and the sum of college completions from the years 1995-96, 1996-97, and 1997-98. This table shows how the computer support students are distributed around the state, in comparison to the cluster-wide demand in each region. The table shows that about 3,400 persons completed at least 45 credits in IT programs before leaving the colleges over the three academic years from 1995/96 through 1997/98. If only those students are considered in relation to projected demand, then projected demand from employers in this state outstrips the supply leaving the community and technical colleges statewide by a factor of about three to one. However, the projected demand is heavily concentrated in a few urban areas, and colleges in Pierce County and in the most rural SDAs (Northwest, North Central, Tri-County, and Eastern Washington) are producing more IT exits than local employers are likely to be demanding. These regions may be supplying workers to the parts of the state with excess demand. However, if one considers all levels of completion as contributing significantly to the supply of computer support workers, including even the most minor level of 3 credits completed or enrollment for 6 credits, then the potential supply nearly doubles. About 6,600 persons took some level of computer related training in the colleges statewide, as compared to a projected three-year demand level of slightly over 10,000. Are employers getting what they need when so many students leave without

completing a recognized course of study? Or are the colleges failing to recognize what students need to get a good job when they insist that a student who only takes a course or two is an "early leaver?" The outcome data with respect to employment and wages in Table 1 demonstrate that many of these early leavers are subsequently employed. However, employers are not required to report occupations to the state in their quarterly covered employment reports, and consequently, it is not known whether these early leavers are employed in occupations related to the fields they took courses in at the community colleges. These statistics suggest that other labor market indicators such as wage levels of early leavers and unemployment rates need to be considered, and that more complete information is needed about why students leave these fields of study after undertaking only a few courses. In particular, prior education and job experience of community college students are likely to be important factors.

These comparisons raise several questions, the first of which will be addressed to some degree in the following sections of the report.

- Are the OES projections for computer-related employment in Washington State underestimates, given alternative estimates of potential demand from groups such as the Washington Software Alliance, in combination with our own survey and the high tech multiplier work discussed below?

- If the primary demand for computer-related supply remains in the more heavily populated regions, what are the implications for completers in the other regions that are offering more training than their local economies can absorb? Many of these students take computer applications courses, and they may be employed outside the fields included in the Computer Support cluster. It is also possible that colleges offer these courses in part to support economic development efforts of regions trying to attract high tech investment. These issues require further investigation to interpret the supply/demand balance at a regional level.

- How do employers view students who enter the workforce with only a few IT related courses completed? Are these students adequately trained for successful careers? Are the students who take a few courses already employed, and using the college system to increase their skills and get a promotion? Maybe this field is evolving so rapidly that the colleges in effect are engaged in a substantial customized training effort that should not be assessed in the same way as completions in other fields where the employment situation is more stable.

Table 2 - projected IT openings over three years compared to the sum of annual completers from 1995-1998

	Region	Projected Openings	Less than 45 credits	45+ credits; 2.0+ GPA	Certificate	Degree	Worker Retraining Program	All Exiters	Total Number of Completers (45+ credits or higher)	Annual Openings Minus Completers	Completers as Percentage of Annual Openings
1	Olympic	309	262	97	26	66	3	454	192	117	62%
2	Pacific Mountain	420	215	71	19	100	2	407	192	228	46%
3	Northwest Washington	147	201	89	25	133	1	449	248	-101	169%
4	Snohomish County	777	367	96	118	144	1	726	359	418	46%
5	Seattle-King County	7,233	1,193	468	525	442	1	2,629	1,436	5,797	20%
6	Tacoma-Pierce County	327	414	142	213	119	23	911	497	-170	152%
7	Southwest Washington	423	154	31	31	36	0	252	98	325	23%
8	North Central Washington	48	57	15	1	37	0	110	53	-5	110%
9	Tri-County	45	60	29	8	41	3	141	81	-36	180%
10	Eastern Washington	48	63	25	9	27	0	124	61	-13	127%
11	Benton-Franklin	111	72	42	0	31	0	145	73	38	66%
12	Spokane Area	273	146	39	26	40	1	252	106	167	39%
		10,161	3,204	1,144	1,001	1,216	35	6,600	3,396	6,765	33%

Data source: State Board for Community and Technical Colleges, based on Participant Outcomes Data Consortium protocols linking college and Employment Security Dept. records
Employment Security Annual Projections, 1998-2008

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The Impact of Information Technology Expansion on Other Occupations

When software and Internet-based companies expand, they require a substantial number of new workers. In addition, their expansion induces expansion in other parts of the economy. The payroll of the IT-oriented companies gets spent by their workers on food, clothing, recreation, transportation, housing, and other goods and services. In addition, the IT-oriented companies purchase goods and services from other companies as part of their direct business operations. Input-output models are tools invented to trace the impacts of these spending decisions on a particular economic region. Washington is unique in having available a series of input-output models created at the University of Washington to model the impacts of the expansion or contraction of various industries. Starting with School of Business economist Philip Bourque's work in the 1960s, and aided at various points by the Geography Department's William Beyers, a series of input-output models was crafted and used, particularly by Beyers and various colleagues in studies of the impacts of such diverse activities as professional baseball and football, the entire range of arts in the Seattle area, and the impact of high tech industries on the state economy. Using Beyers' study of the impact of high tech industries as a base,[4] we have extended this analysis by adding on occupational information so as to predict the occupational impact of the expansion of one high tech sector, software.

Beyers and Lindahl estimated that each new job in the software sector results in a total of 5.409 total jobs in the Washington economy. With the assistance of Beyers, this total impact was disaggregated into the number of jobs created in each industry sector in the input-output model. We then used the Employment Security Department's industry by occupation matrix, created to build the occupational forecasts discussed above, to estimate the staffing pattern for each of Beyers' industry sectors. The industry by occupation matrix models the use of some 700 occupations in about 500 different industry classifications. We therefore had to aggregate 500 industries modeled in the industry by occupation matrix into the 23 sectors used in the input-output model, yielding staffing estimates for the 700 occupations for each of the 23 input-output model industry sectors (see industry list below). Government is not included in the input-output model; this is unfortunate since government employment in general and its IT employment in particular appears to be growing.

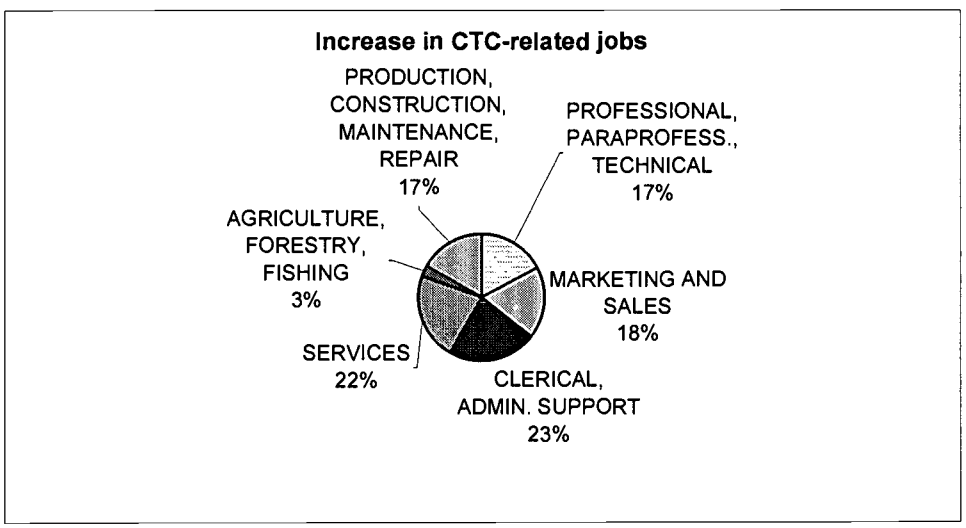
Input/Output Model Industry Sectors

Agriculture	Forestry/Fishing
Mining	Food Products
Apparel	Wood Products
Paper Products	Printing
Chemicals	Petroleum
Stone/Glass/Clay	Primary Metals
Fabricated Metals	Industrial Machinery

[4] Beyers, William and David Lindahl, *The Economic Impact of Technology-Based Industries in Washington State*, University of Washington, Report for the Seattle Technology Alliance, November 1996.

Electrical Machinery	Aerospace
Ship Building	Other Transportation Equipment
Other Manufacturing	Construction
Transportation Services	Communication
Utilities	Trade
Finance/Insurance/Real Estate	Business Services
Health Services	Other Services

We then assumed that software expanded by 1,000 employees and distributed the total job impact of 5,409 across the 23 input-output sectors as required by Beyers' high tech model. The total jobs in each of the input-output sectors were then distributed across the 700 occupations in proportion to the percent of each occupation in that sector's total employment (these proportions may change over time as industry structures change but this analytic approach "freezes" both industry production processes and staffing requirements at a particular point in time). By then adding up all of the jobs in each occupation across all of the sectors, the total jobs by occupation resulting from the expansion in software was obtained. These occupational impact estimates were then subjected to our standard screen for those occupations of concern in the community and technical colleges; most occupations requiring a bachelor's or higher level university degree were dropped, as well as many of those requiring only very short term training (some selected occupations from these latter two groups were included where there was evidence that the CTC system provided closely related training). The resulting estimates, summarized in the chart below, show the potential impact of a software expansion on major occupational clusters.



It should be noted that opinions vary about how such an impact would unfold over time, and how long that period of time might be. These numbers are meant to be broad estimates that can best be viewed as indicators of direction and magnitude of change rather than extremely specific predictions--as is the case for most efforts to project economic or employment change.

With a total increase of 5,409 jobs, over two-thirds (3,897) of these could be in CTC-related fields. This increase would be well distributed throughout the different major occupational clusters except for agriculture, with double-digit percent increases estimated in professional/paraprofessional/technical, marketing/sales, clerical/administrative support, services, and production/construction/maintenance repair. Within those major clusters, there would be increases of 100 or more jobs in computer support, health practitioners, clerks, food, medical and miscellaneous services, maintenance and repair, construction, and drivers. Thus, it appears that an increase in software employment would be likely to yield significant increases in other occupational employment over a wide range of jobs and industries. These increases are likely to have a considerable impact on the community and technical colleges, and should be noted during future planning efforts *(the spreadsheet with 400+ such occupations listed is available on request).* The software sector has expanded by over 8,000 in the past year according to Employment Security Department reports, thereby providing a substantial driver for workforce demands in many of the occupations the community and technical colleges focus on.

Survey of Information Technology Workforce Needs

A mail survey of a 5% random sample of selected industries was conducted in May 2000 to determine current and future needs for Information Technology workers among Washington companies. As shown in the accompanying table, several sectors were selected because Employment Security occupational data, the data examined in the rest of this report, suggest a significant concentration of IT workers. In addition, a random sample of other companies was selected. Our purpose in conducting the survey was to complement a survey conducted for the Washington Software Alliance two years ago, focused on the workforce needs of software companies.[5] That survey indicated very aggressive hiring plans within the software industry, but shed no light on needs for programmers, database administrators, or network coordinators among organizations in other sectors of the economy. Therefore, we used a similar survey instrument to gain comparable data.

The sample frame for this survey was developed through an analysis of the industry by occupation matrix developed by the Washington Employment Security Department (ESD) as part of its occupational projections program. The matrix provides a detailed estimate of staffing patterns by industry. ESD provided a copy of the full matrix with detail on approximately 500 industry sectors and 700 occupations; these data are considered confidential and cannot be published in full because individual employers could be identified through study of the data. We pulled all IT related occupations[6] out of the 1996-2006 version of the industry by occupation matrix, and aggregated these estimates of IT worker utilization up into the industry categories displayed in the table below. Based on this information, we decided to concentrate our survey on communications, insurance, business services, and government agencies. While transportation services is a major contributor to IT worker demand, this sector is dominated by The Boeing Company. Boeing's employment is very cyclical but is not likely to increase on a sustained basis. This sector also includes a large truck manufacturer and some shipyards. A single large company is always reluctant to reveal details of its internal business operations to the public, and a survey that includes results from Boeing is always prone to doing this due to Boeing's size. Therefore, the survey results below do not include any estimates of IT worker requirements from Boeing, but readers can infer some information from the table below about the likely IT demand if Boeing's workforce increases in size, or if an estimate of replacement worker requirements is otherwise developed for the transportation equipment industry. In addition, while the remaining manufacturing sectors taken together account for 13% of IT employment, such employment appears to be thinly and irregularly spread through a very wide range of manufacturing activities; thus, the rest of the manufacturing sector was not considered to be a practical survey target in this relatively small sample. The final sample design along with the number of respondents is shown in an accompanying table, and further discussion of survey procedures is provided below.

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[5] Sommers, 1998., op. cit.

[6] The Information Technology worker categories we used in this analysis include systems analysts, database administrators, computer support specialists, computer programmers, computer programmer aides, and all other computer scientists.

The survey was mailed to about 1,800 recipients in early May, followed by a postcard reminder 10 days later. A second survey instrument was mailed 10 days after the postcard, and a week after the second survey was mailed, a team of research assistants conducted follow-up telephone calls to as many survey recipients as possible, concentrating on larger firms. These procedures yielded over 500 responses, 440 of which contained usable data, an overall response rate of 24.6%. However, many of the respondents answered only a handful of questions on the first two pages of the survey. Questions about detailed staffing patterns, and the education and experience requirements for particular positions, were answered by few of the respondents. Because follow-up was more intense among the larger survey recipients, a higher response rate was achieved for these firms – 36.9% for firms with at least 50 employees versus 22.1% for firms with less than 50 employees. These response rates indicate that the larger firm results should be somewhat more reliable as indicators of conditions among all firms of this size in Washington when results are extrapolated up to population levels in the tables below.

The smaller firm results are more speculative in the sense that the response rate, roughly 1 in 5 of the sampled firms, who in turn were randomly selected to represent 20 similar firms, provides a small and perhaps less representative sample. One puzzle in the results is that no responses were received from communications (telephone and other communications service providers) companies or insurance companies. Many of the sample companies in these sectors are multi-establishment companies who may have found it difficult to compile results from multiple locations. Accordingly, the analysis below relies on results mainly from the large firms, and reports answers only on those questions for which we have adequate responses to serve as a basis for projecting sample responses to statewide levels.

Information Technology Workers by Industry

Industry	Projected Annual Openings, 1996-2006 Total IT	% of IT
Agric/For/Fishing	22	0.04%
Mining	7	0.01%
Construction	44	0.08%
Manufacturing	14,157	25.14%
Transportation Equipment	6,786	12.05%
Transportation/Communications/Utilities	2,621	4.65%
Communications	1,230	2.18%
Wholesale	1,312	2.33%
Retail	1,572	2.79%
Finance	4,285	7.61%
Insurance	1,550	2.75%
Services	25,396	45.10%
Computer Programming/ Data Processing/Other Computer Services	14,563	25.86%
Government	6,899	12.25%
Total (does not include indented lines above--each indented category is included in the line above)	56,315	100.00%

Source: Washington Employment Security Department, 1996-2006 industry by occupation table

Sample Frame and Respondents by Industry

	Larger Firms (at least 50 employees)		Smaller firms (up to 49 employees)	
SIC	Sample Mailed	Returns	Sample Mailed	Returns
Other sectors	43	11	414	22
Communications	9	0	30	0
Insurance	9	0	26	0
Business services	39	12	297	66
Health services	46	16	381	138
Educational services	34	13	32	21
Engineering & related services	30	9	293	79
Government	88	49	16	4
Total	298	110	1,489	330

Who Is an Information Technology Worker

For purposes of the survey, we provided respondents with a list of Information Technology occupations, and a brief description of the occupation. This list is reproduced below. Survey results referring to IT workers in total include all of these occupation types. As the small business owner's letter quoted on the next page shows, these roles may be filled by other workers in small firms.

Information Technology Occupations

Computer programmers write the sets of instructions, or code, that direct computers to perform specific tasks (includes applications developers).

Computer security specialists regulate access to computer data by setting up Internet firewalls, encrypting data files, and establishing secure websites for transactions.

Computer support technicians install and support computer hardware and software. They may also run help desks.

Computer support specialists provide the lowest level of technical support to customers, clients, or members of a firm or organization by using computerized databases or reference books.

Computer system analysts coordinate with management, network administrators, and computer users within a company to determine the proper hardware, software, and reporting requirements to meet the information needs of the organization.

Database administrators are responsible for the oversight of a company's computer database files, such as inventory, accounting, payroll, mailing lists, and customer account files.

LAN/WAN administrators are responsible for the overall networked computer system inside a firm; in smaller organizations they may also do the work of the network technician.

Computer networking technicians install and support computer software and/or hardware relating to networked computers.

Multimedia technicians combine audio, video, graphics, animation, and text to provide and disseminate information to others in an aesthetic manner.

Webmasters are responsible for developing and maintaining the world wide web (WWW) servers and one or more webpages for a company; they are part-time programmers, network technicians, and customer support specialists.

Quality assurance specialists develop, apply, and maintain quality requirements that include the design and implementation of procedures for testing and debugging programs and products to ensure that they conform to accompanying documentation specifications, are bug-free, and are stable.

Analysis of the survey data revealed that most of the respondents are from quite small organizations that cannot afford to hire dedicated IT staff. However, computers and computer technology are pervasive throughout the economy these days, and many of these small firms and public agencies need staff with IT skills. The dilemma these organizations face is summed up eloquently by a letter received from the owner of a small scientific services company:

> "I have attempted to fill in the enclosed questionnaire; however because our firm has only 7 full-time employees many of the questions do not seem to fit. We are, however, in a field that is heavily dependent upon technology ... and greatly impacted by the difficulty of filling IT roles ... several of our fisheries biologists are currently performing IT functions (programming, database admin, etc.), and I am struggling to perform some of the network admin and web admin roles (although by training I am a contract manager and technical writer)."

As this firm owner indicates, IT roles are filled by staff with other primary job titles and functions in many small companies and agencies; the survey results reported here do not capture the need for IT skills in these smaller organizations. The median response from small firms responding to the survey is zero current IT employees and no plans to hire specialized IT staff in the next three years. However, these same firms may be struggling to build IT skills among their current, less specialized staff. This is a gap in workforce skills that the community and technical colleges could explicitly focus on through short courses, customized training programs, web-based tutorials, or other delivery mechanisms.

Due to the difficulty of dealing with IT issues in smaller firms, we decided to split the sample into two segments, firms with less than 50 employees, and those with 50 and up. Since we conducted more intensive follow-up among the firms with more than 50 employees, it also makes sense to report results separately for these larger organizations. The tables below show the responses extrapolated up to statewide levels for the larger firms.

The basic questions on the survey, for which we obtained the largest number of responses, asked firms to tabulate their current full time employment level and the number of IT workers currently employed. We then asked the respondents to project these two figures—total and IT employment—three years into the future.

For the small firms, the median number of all employees now and in the future is seven. If growth is occurring among this class of firms, it is evidently through the formation of new firms, not the expansion of the existing ones. Consistent with this finding, the median number of IT employees currently and in the future is zero. As indicated above, IT functions are handled by staff with other primary functions, and these firms expect to continue to operate in this way in the future.

For larger firms, detailed responses are shown in the next table. These firms currently employ an estimated 45,700 workers statewide, including over 1,150 IT workers among their permanent, full-time workforce. In addition, they are using 118 IT people supplied by staffing or temporary help services, and they are contracting with 960 self-employed IT specialists. These results indicate that the use of contingent workers is currently almost as great as their full-time permanent IT workforce. Over the next three years, these larger firms expect to expand by nearly 32 percent, and they expect to add another 3,085 full-time, permanent IT workers, an expansion of 167% percent in the IT workforce. Their projected use of temporary employees is also expected to increase by 21 percent. Insufficient responses were obtained concerning future use of self-employed contractors and this variable cannot be projected into the future.

The full time IT worker results indicate a structural shift going on among these firms. IT workers currently constitute 2.5 percent of their full-time permanent workforce, but by 2003 the larger respondents expect IT workers to double to 5.2 percent of their full time permanent workforce. It is possible that part of the increase in permanent IT employees could come from absorbing contract workers into the permanent workforce of these companies, although the survey results are not complete enough to justify this conclusion. If all of the contract workers were to be converted to permanent, full-time workers at these companies, then 960 of the 1,926 new jobs would be occupied by current contract workers, leaving 966 net new jobs on top of the absorption of the contract workers. If the contract workers remain at the current level, then all of the increase in permanent full time jobs represent projected new job openings. Clearly, IT is a growing area within a set of expanding large companies in the Washington economy.

Current and Projected Employment Levels Among Larger Organizations (50 or more employees)

Employment	Company Wide (in Washington)	Information Technology*		
	Full Time/ Permanent	Full Time/ Permanent	Provided by Temp/Staffing Service	Self Employed Contract Worker
2000	45,137	1,156	118	960
Company Projections: 2001	54,587	1,382	141	n/a
2002	58,560	1,526	143	n/a
2003	59,510	3,085	128	n/a

In conclusion, these survey results demonstrate that the IT workforce is rapidly expanding in the State of Washington among a variety of employers, especially in the service industries and in government agencies. These employers of programmers, database and network administrators, and other IT workers see substantial expansion opportunities in the three years ahead, projecting a 31 percent expansion of their overall workforce and a shift in IT employment from 2.5 to over 3 percent of all employees. On an annualized, compound growth basis, this 31 percent expansion is equivalent to a

compound annual growth rate of 9.65 percent. The implied compound growth rate for IT workers is 38.7 percent annually if the contract workers are not considered part of the 3,085 new IT workers, and 13.3 percent of the contract workers are completely absorbed into the permanent full time workforce.

The expansion of IT workers suggested by the survey can be compared to the openings due to growth in the state's occupational projections. Those projections show a 69.3% percent increase over 10 years from 1998-2008, from 39,380 employees to 66,680. However, the computer-related occupational titles used in these projections, as mentioned earlier in this report, may not constitute a good match with the titles currently used by employers (for example, webmasters are not included in any of the computer-related titles in the occupational classification system used in state projections; they are classified with all other artists); therefore, the value of this comparison is somewhat limited. While this survey was relatively small and limited to certain economic sectors, it does suggest that the 69.3% state-projected increase is likely to be an underestimate. The community and technical colleges that train students to enter computer support occupations should regard the long term forecasts from the Employment Security Department as a lower bound estimate, and the colleges may want to plan for higher enrollment levels in these fields. In addition, many students may seek to augment their primary training in some other field with some computer related skills if they expect to work in small firms that cannot afford to hire IT specialists. The small firms in Washington add another component to overall demand for IT skills, particularly if the colleges tailor special offerings to meet this needs through such mechanisms as short courses and web-based tutorials.

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