

3-1-1997

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Recommended Citation

Clark, Linda D. (Linda Darlene); McKinney, Gary (Gary Russell); and Simpson, Carl, "Assessment of Kitsap Employers' Needs Regarding Computer Science Training: Summer, 1996" (1997). *Office of Survey Research*. 464.
https://cedar.wwu.edu/surveyresearch_docs/464

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The Office of Institutional Assessment and Testing • Western Washington University

Volume 2, Issue 3

March, 1997

Assessment of Kitsap Employers' Needs Regarding Computer Science Training -- Summer, 1996

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with Linda Clark and Gary McKinney

Introduction

During July and August of 1996, the Western Washington University Office of Survey Research conducted a survey of Kitsap employers who might employ computer specialists and who could therefore indicate a) what kind of future openings there are in Kitsap County for computer scientists and b) what kind of market there is in Kitsap County for courses in computer science. The survey was initiated by Western Washington University Extended Programs to ascertain the advisability of expanding Kitsap County offerings in the area of computer science. This report presents the findings of our survey.

Method and Sample

Telephone and optional mail surveys were completed with 45 of Kitsap County's largest employers. Our approach was to in-

crease reliability by including in our sample all employers judged by an expert to be likely to hire computer specialists, and also to include a companion random sample of all large employers in Kitsap County. The resulting sample size is one that allows considerable room for error. However, the inclusion in our sample of all employers judged likely to employ any computer specialists means that generalization to all Kitsap employers is safer; most of the relevant employers were, in fact, included in the sample.

The pool of potential employers for inclusion in this survey consisted of a May, 1996 listing of all employers reported as doing over one million dollars in business annually in Kitsap County. Although some smaller employers might hire computer experts, very few are likely to employ the kinds of specialists in which this study is interested. For this survey to be powerful yet represent all Kitsap employers at a modest cost, we stratified our sample of



employers in two ways. First, we identified employers whose industrial sector and size made them particularly likely to employ computer specialists, taking all such employers as one stratum and all others as a second stratum. We called the first group of public and private employers likely to hire computer specialists the *primary sample* and included all of them in the survey sample. We called the second group our *random sample* and divided it according to gross earnings of the employers. This allowed us to sample nearly all employers in the largest category and progressively fewer in each stratum of lower income, producing a random sample of 15 in each stratum. By over-representing larger employers, we get the most reliable information where staff size indicates greatest potential to consume training and greatest potential for a significant staff of computer experts. By also including a sample of smaller employers, we add the safety that our extrapolation to all Kitsap employers will avoid the error of assuming no computer staff for those organizations whose name or whose size implied little likelihood of a computer staff.

Table 1 presents the strata, the number of employers in the potential pool in each strata, the number included in our sample, and the disposition of our calls in each stratum and in total. Several aspects of Table 1 are worth noting here. First, the turnover in businesses is remarkable, especially in the primary sample, where 26% (10 of 38) businesses no longer existed in Kitsap County as of our July/August survey, or were originally listed in error. This volatility means a) employment stability in Kitsap may be low, and b) there may have been a number of new employers growing up to replace those that vanished. If new employers grew up since our sample list was compiled, our survey missed them. An adjustment will be made to account for that possibility.

Table 1: Sample Pool, Strata, and Disposition

	# in Pool	# in Sample	Disposition			
			Not exist/ Duplicate*	Completed	Refused	No Response
Primary Sample Strata**						
\$5 million earnings and up	10	10	3	5	1	1
\$3-5 million earnings	7	7	1	4	0	2
\$1.8-3 million earnings	11	11	5	2	1	3
\$1-1.8 million earnings	3	3	1	1	1	0
City/County/US(base)	7	7	0	3	0	4
Total Primary Sample	38	38	10	15	3	10
Random Sample Strata***						
\$5 million earnings and up	38	15	1	7	1	4
\$3-5 million earnings	46	15	4	9	1	1
\$1.8-3 million earnings	77	15	4	10	0	1
\$1-1.8 million earnings	156	15	6	4	1	4
Total Random Sample	317	60	15	30	3	10
Total Both Samples	355	98	25	45	6	20

*This category includes organizations no longer doing any business in Kitsap County (if anywhere) and two cases in all where the sample included two listings for the same business.

**The primary sample consists of those organizations with earnings of more than one million dollars, and thought most likely to employ computer specialists.

***The random sample consists of those organizations with earnings of more than one million dollars, and not included in the primary sample.

Second, the response rate we received in the primary sample, the one we cared most about, was lower than we are accustomed to experiencing. We completed 54% (15 of the 28 organizations still in existence), a percentage generally regarded as acceptable, but not excellent. However, in similar surveys, using the same technology, we are accustomed to completing 65-70%. Indeed, we completed surveys with 67% of the existing organizations within the random sample (30 of the 45 in existence), about the best we would expect given Summer vacation schedules. Based on the effort we put into completing calls and on the attitude of several businesses that failed to respond, we think this low response rate is indicative of a lack of enthusiasm concerning the possibilities that motivated this study.

The techniques we used to secure the highest possible return rate were at the highest standard for the field. Unless they requested a mail version of the survey, every organization in the sample was called multiple times until it became clear that they would not respond by telephone. They were then sent a mail version and then a mail reminder before being declared non-responders. In this sense, a fair proportion of non-responders were, in fact, refusals, although not quite in so many words. In other cases, the individual with whom we needed to speak was on lengthy Summer vacation or was apparently (according to staff) a workaholic who simply gave our survey low priority. One particular set of non-responses was unfortunate for our findings: four employers on Bangor Base all said they were restricted by policy from giving information on the phone and requested written forms, which they failed to return.

The final observation about the sample is related to the second: Our initial contacts with this sample of employers gave very little reason to be enthusiastic about their responsiveness to the possible computer science training programs that stimulated this survey. More than usual refused the survey, several were rude when doing so, several included the message with their non-response that they didn't think they had any interest in the survey or the training, and none indicated any positive enthusiasm for our programs, in dramatic contrast to our 1995 survey of Port Angeles employers. While this observation is only ancillary to the main findings, the survey process does make it appear that the primary sample of likely computer expert employers is not highly enthusiastic about what Western has to offer.

Findings

The approach taken here is to express findings in terms of our best estimate as to the total number of employers in Kitsap County who gave each response. This means that we are reporting *projections* expressed in actual numbers of employers, openings, etc.

To calculate these projections, we weighted responses in each stratum so as to expand them into the full number of existing employers in the pool for each stratum. The only exceptions to this approach were two very large employers that were obvious outliers (the only relevant employers in their size category in Kitsap County). These were exempted from the weighting, producing the most accurate estimates possible with a small sample.

One problem with this approach is the apparent turnover in employers. We adjusted the sample pool downward to account for employers who were in fact listed twice or who had gone out of business or who no longer had offices in Kitsap County. However, if many employers had gone out of business since our listing was formulated, presumably others have formed. Any decision as to

the replacement rate involves assumptions. The assumption we worked with was to set the expansion figure at slightly below the proportion of the original pool that had apparently gone out of business (as opposed to other reasons for being incorrectly listed as in the pool). We therefore adjusted final figures to reflect a presumed undercount of about 15%. If this figure is low, our estimates are low; if it is high, our estimates are high.

The errors of estimates reported in this survey are based on the original sample, not on the numbers reported in each table. Based on a sample of 45, the standard 95% confidence interval would ordinarily be reported as plus or minus 14-15%, depending on the figure estimated. However, since one-third of our sample--the primary sample--represents 54% of the organizations by far most likely to make extensive use of computers, the actual error is reduced by something like 20%. The best error estimate for the reader to keep in mind while viewing these results is, therefore, about plus or minus 12%.

Nature of Employers in the Sample

Since we contacted the largest employers in Kitsap County, the sample includes several employers with large numbers of employees. Still, most employ small numbers. We project that 29.6% employ 10 or fewer, 26.6% between 11 and 20, 16.9% between 21 and 40, 18.5% between 41 and 200, and 8.4% over 200, with the largest employers in our sample employing 488 and 950 in Kitsap County. Of course, the number of employees represented by each size group is heavily weighted to the large employers.

To measure the number of computer specialists employed in Kitsap County, we asked each employer "how many, if any, of your employees work with computers in *ways more complex than word processing or routine record keeping*." The attempt here was to eliminate from the count purely clerical functions for which college training in computer science would be inappropriate. No doubt, there is considerable slack in employers' interpretations of this question, a possibility we consider later in this report.

We project that about half (51.8%) of large Kitsap employers have no full-time computer specialists on staff, and three-fourths (72.5%) have no employees for whom computer specialist work would be "*one substantial part of their duties*." For simplicity, we will refer to these employees as part-time computer specialists. We project that 9.2% of Kitsap employers have more than 10 full-time computer specialists. Among the remainder, 16.7% employ one or two, 15.8% employ 2-5, and 6.6% employ 6-10 full-time computer specialists. The parallel figures for part-time computer specialists are 10.0% with 1-2 employees, 6.9% with 3-5, 3.1% with 6-10 and 7.4% with more than 10.

Adding together the full- and part-time computer specialists in all companies, we project about 940 full-time and 1170 part-time computer specialists among large employers in Kitsap County and perhaps a very small additional number among companies with gross earnings too small to qualify for the sample. The few largest employers who make extensive use of computer specialists account for over one-fourth of full-time computer specialists, with one company employing 250 and the next highest employing 40. Findings for part-time computer specialists are similar, with 238 as the highest figure and six others employing between 80 and 150.

Projected Openings for Computer Specialists

The “bottom line” estimate for this survey is the demand in Kitsap County for computer specialists for whom the Bachelors degree in Computer Science is appropriate. The first step in arriving at that figure is a projection of the total number of full-and part-time computer specialist positions opening per year for the next five years. Employer estimates over a five year period are, of course, subject to error, but they represent the most accurate data available. Table 2 displays the number of replacement positions (current employees whose “positions are likely to be opening to hire within the next five years, due to retirement or other turnover”) and the number of new (expansion) positions. In each case, the positions were defined as involving “non-routine work with computers.”

What we see in Table 2 is a remarkably small number of replacement openings in the next five years, presumably because so many current computer specialists were hired too recently to be close to retirement, and modest planned expansion. In total, we project about 73 new full-time and 98 new part-time computer specialist openings each year for the next five years. While these are our best estimates, we also estimate that the 95% confidence interval includes the range 64-82 full-time and 86-110 part-time positions.

Table 2: Number of Computer Specialist Openings Forecast for the Next Five Years and Per Year

Replacement Openings	In 5 years	per year
Full-time	144	29
Part-time	101	20
New Positions		
Full-time	219	44
Part-time	389	78
Total Openings		
Full-time	363	73
Part-time	490	98

To determine the number of *appropriate* openings, we need also to consider educational requirements. Of the entire sample, 45.0% have no full-time computer specialist openings in the next five years and 50.8% have no part-time openings. For the rest, we asked whether all, most, half, some, or none of their computer specialist openings will require a Bachelors, Masters, or less than a Bachelors. We found a projected 21 employers who will hire all full-time positions with Bachelors or Masters (nearly all Bachelors), 28 who will hire about half at Bachelors+ and 10 who will hire “some” with Bachelors. For part-time computer specialists, the figures are 11 all, 21 half, and no others. All other employers of computer specialists are projected to hire no BA levels among their computer workers. In part, this suggests that our specification of computer specialist

work as “non-routine” may have the subject of divergent interpretations. Thirty employers will hire both full- and part-time computer specialists. Two will hire only full-time and 19 plan to hire only part-time.

Taking into account how many new positions will be opened to hire by each of the employers who will hire at least some at the Bachelors level, we calculated approximately how many Bachelors level computer specialists will be hired in the next 5 years. For purposes of calculation, we included 100% of openings if they said “all” would have Bachelors, 75% if they said “most,” 50% if they said “half,” and 25% if they said “some.” We estimate that of the projected 73 full-time openings in each of the next five years, approximately 39 will require the Bachelors degree or above. For part-time, of the projected 98 openings per year we estimate 48 will be at the Bachelors level. Two-thirds of these, 32 per year, will occur with a single employer.

The next question is how many of these positions are ones for which “a degree in computer science is required or strongly preferred?” We found just over one-third (36.4%) of employers who planned to hire Bachelors level full- or part-time computer specialists requiring or strongly preferring a computer science major. That means we project approximately 32 Bachelors or Masters level full or partial computer specialist positions opening per year for the next five years in Kitsap county that will require or prefer the degree in computer science.

Where employers indicated that they would not prefer computer science graduates, we asked what fields they favored. Although some of these employers (23%) will allow computer science majors to apply and compete on an equal footing with other fields, the majority indicated that they preferred business-related degrees, specifying accounting, business or marketing (54%), or engineering degrees (23%).

If half of the positions open to computer science graduates and other majors ended up hiring Computer Science majors, annual hiring for computer science graduates would increase by 10, for a total of 42 per year. Assuming that would be the case and assuming an error of about 12%, we project between 38 and 46 total positions per year open to computer science graduates, not encouraging for a program to prepare computer science bachelors graduates in Kitsap County given other sources of supply.

Projected Training Needs Among Current Computer Specialists

Employers were asked “If appropriate college training in computer science were available in Kitsap County, how many of your *current* employees would you send to take courses in an average year?” We probed to record how many would be sent after work hours only and how many would be sent at any time, including during their work days. We project that of all computer specialist employees, both full-and part-time, employers in Kitsap County would send 199 to training during any available hours and 292 others would send employees for training only after hours, for a total of 491.

Since this issue was not the primary focus of this survey, we asked no further questions regarding the extent of the training that would be required. We did, however, ask about the types of computer skills required by each employer. The responses concerning full-time computer specialists are listed, alphabetically, in Table 3.

Table 3: Types of Computer Expertise Needed by Employers of Full-time Computer Specialists

Needed Expertise	Number of Employers Expressing Need*
A5400	1
Accounting	4
Escrow Accounting	1
AP/AR	1
Application and Platform Knowledge	1
CAD	1
Cobalt	1
Data Analysis	1
Data Base	2
Data Entry	1
DOS	1
Drafting	2
Excel	3
General Hardware Knowledge	1
General Software Knowledge	3
Graphic Art	1
Hardware Repair	2
Hewlett Packard 3000 Environments	1
MIS	1
Networking (especially LAN)	3
Novell	2
Programming	3
Software Technical Training	1
Spread Sheets	2
Specific Company Programs	1
Systems Analysis	2
Unix	1
Windows	1
Word	2
TOTAL	47

*Based on responses by 28 employers. More than one response was allowed.

Responses for part-time computer specialists are almost identical except that they are somewhat more often clerical in nature. In addition to responses in Table 3, we can report that a substantial proportion of employers mentioned that their greatest computer training interests lie with increasing expertise in the use of standard software such as spreadsheets. None volunteered a wish for training in the basic theory of computer science.

Table 3 reports employers' responses in very specific terms and is therefore presented without comment except to note the relatively broad scope of skills required by this set of employers.

We can also add to the picture painted by Table 3 with employers' estimates of the directions their computer applications will be taking in the future. Employers were asked: "What would you say are the major new directions your organization's computer needs are taking in the foreseeable future?" Responses are shown in Table 4.

Table 4: New Directions in Computer Needs Foreseen by Kitsap Employers

Response	Number of Employers Foreseeing Need*
Automatic Systems	1
CAD	1
Data Entry	1
EDI	1
General Expansion	3
Hardware Upgrades	2
Imaging on Paper/Fiche to Binary Coding	1
Internet	5
More Technical/Software Upgrades	3
Networking (LAN, WAN, Specific Systems)	10
Oracle	1
Software Training	1
Subcontracting to Automated Systems	1
Unix	1
Total	32

*Based on responses by 24 employers. More than one response was allowed.

The picture here is much different from that painted by Table 3 in that Table 4 responses cluster around a few topics. One-third of employers emphasize networking and another sixth point to the internet. The remaining half of responses are more varied.

Understanding More About the Work Done by Computer Specialists

In order to determine the potential for college-level training in computer science, it is important to understand how much of the computer work being done in Kitsap County involves the types of skills that demand university training. The computer science department at Western, as elsewhere, emphasizes the theory behind computer operation as well as programming capacity, to give students the life-long ability to learn and grow, as well as to create in the computer field. This set of skills is distinct from the ability to operate particular applications effectively.

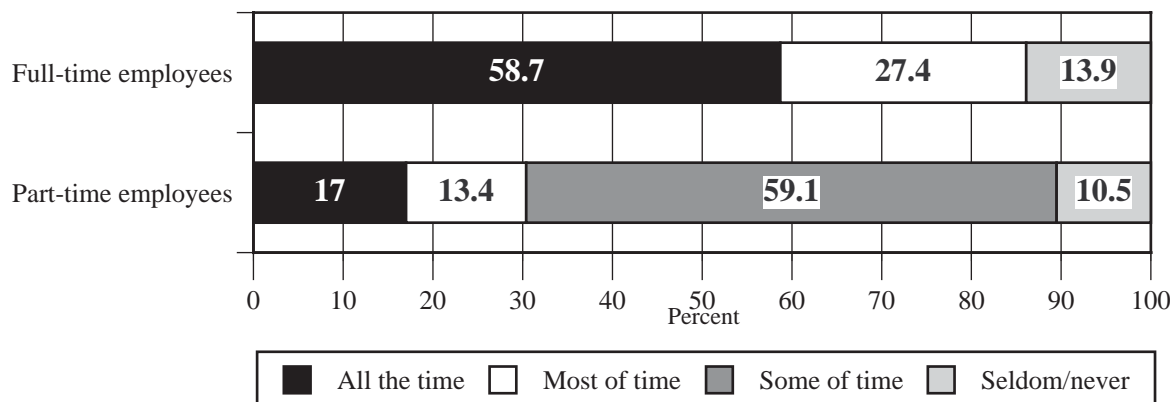
We know from Tables 3 and 4, as well as from comments made by some employers, that many of the employees counted here as computer specialists are not doing the types of work for which a university computer science degree is intended to educate. Figures 1 through 3 provide more information relevant to the advisability of mounting a computer science degree in Kitsap County as well as providing information about the types of training that might be appropriate short of a university degree.

The most basic indication of a need for a university degree is whether or not the employee needs to understand the theory behind the work they do. We asked employers: “How often do [computer specialist] employees need to understand the basic theory behind computers and computer systems?” As Figure 1 shows, the great majority (86.1%) of the employers who have any full-time computer specialists say they need to understand the theory “all” or “most of” the time. On the other hand, only 30.4% of part-time computer specialists fall into the same category, although 59.1% “some of the time” need to understand theory. These findings are the most encouraging of this report concerning the advisability of university level training for computer specialists. Most of these employers do not have a preference for computer science degrees, but at least some of the training provided by such a degree appears to be relevant.

UEP Survey of Kitsap Employers re: Computer Science Needs

How often do employees need to understand the basic theory behind computers and computer systems?

Figure 1

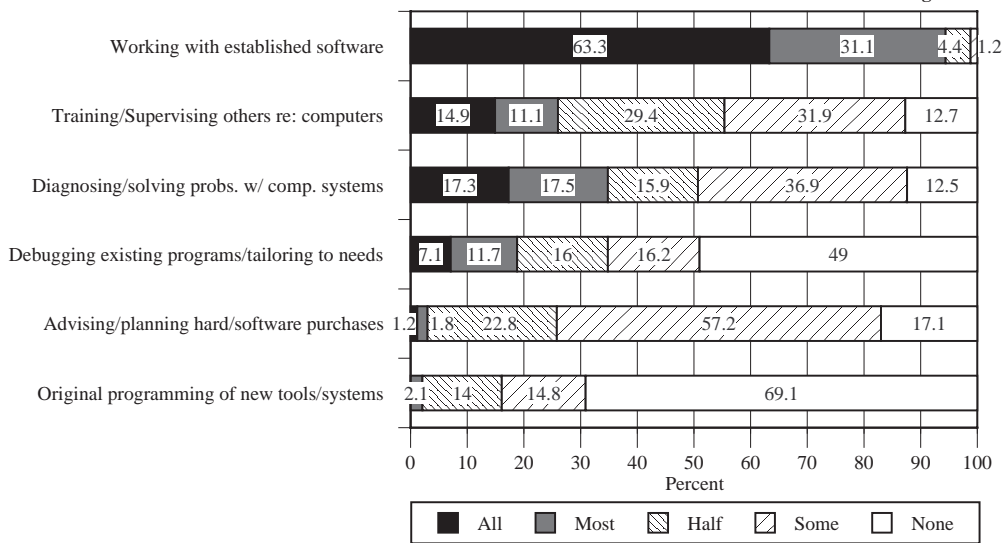


Figures 2 and 3 provide further information, reporting what proportion of computer specialists' jobs involve various tasks or skills. Here, the findings are somewhat less encouraging with regard to a computer science bachelors program. Nearly all computer specialists work with established software, as would be expected (see Figure 2). About half of employers with computer specialists say that half or more of their specialists' jobs sometimes include problem solving with computer systems. About one-third say half or more of their specialists sometimes debug or tailor programs—i.e., need to program well. Over half say at least half of their specialists train or supervise others who do computer work at some level. Only one-fourth of employers say half or more of their specialists advise or plan purchases, and about one-sixth say that many of their specialists do original programming.

UEP Survey of Kitsap Employers re: Computer Science Needs

Of all employees who do non-routine work with computers, how many have job assignments including each of the following:

Figure 2



UEP Survey of Kitsap Employers re: Computer Science Needs

Of all employees who do non-routine work with computers, how many have as one of their primary assignments, each of the following:

Figure 3

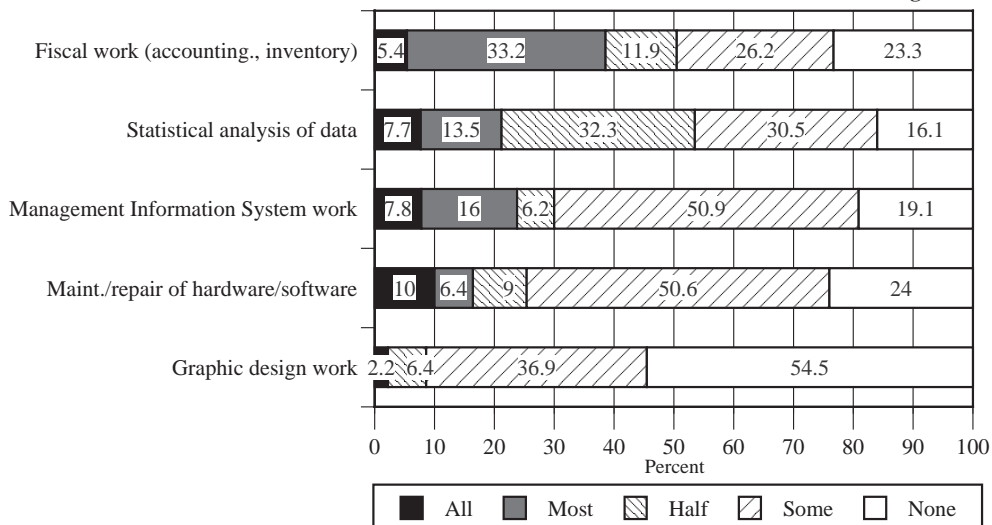


Figure 3 summarizes some major types of job assignments. Fiscal work and statistical analysis of data are the two types of work that more than half of employers say are assigned to half or more of their specialists. When we combine the positions that engage primarily in fiscal work or MIS work, we see why the most frequent type of non-computer science college degree mentioned by these employers come from the field of business. About one-fourth of these employers say that half or more of their computer specialists engage in maintenance or repair of hardware or software. Very few do graphic design work.

Summary

Both the lack of responsiveness of many employers in our sample to a survey concerning computer training needs, and also our projections of the number of positions opening in Kitsap County for Bachelors level computer science positions, provide caution concerning the advisability of mounting a computer science degree program focused specifically on Kitsap County. Findings also suggest that if any related program were pursued, it might be a joint business-computer science program. Even then, demand would be limited.

The survey also finds considerable interest in relatively more specific types of training regarding the use of particular computer applications and networking. It may be most advisable for UEP to enter this market gradually, if at all, offering the most focused, application-specific training courses appropriate at the university level.

published by:

Office of Institutional Assessment and Testing

Dr. Joseph E. Trimble, Director

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