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Department Of Labor Testing: Seizing an Opportunity to Increase the Competitiveness of American Industry and to Raise the Earnings of American Workers

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Abstract

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Keywords

Comments

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DEPARTMENT OF LABOR TESTING
EXECUTIVE SUMMARY

The professionalism that the American military recently exhibited in the Persian Gulf is in no small part due to care with which it selects, assigns and trains its soldiers. The military's success in preparing this highly skilled workforce was made possible by decades of research into occupational competency assessment, aptitude test development and validity research. The Department of Labor is also a world leader in the development and validation of employment aptitude tests and there is now an opportunity for this expertise to be implemented in ways that can enhance the nations's competitiveness and improve the standard of living of all of its workers. This paper describes how an Employment Service job referral system can be developed and implemented to achieve these objectives. It is organized into 6 sections.

Chapter 1 demonstrates that how workers are selected for jobs profoundly effects the rewards for developing the skills and competencies needed by the economy. If attractive jobs are more available to those who have certain skills, the supply of workers with these skills is likely to increase. Students will see a benefit to devoting more time and energy to their studies and parents will see a stronger connection between the quality of local schools and their child's career success.

The benefits of improving occupational competency assessment are reviewed in Chapter 2. Chapter 3 reviews the evidence from military and civilian studies on what predicts job performance. This analysis concludes that different jobs require different constellations of generic competencies, that technical competence in particular is a powerful predictor of job performance in bleu collar, craft and technical jobs. Relevant occupational work experience is also an extremely important determinant of performance. Chapter 4 calculates an estimate of the magnitude of the social benefits that would be generated by a major expansion in the use of VG-GATB for employee selection. The social benefits are found to be very large. This implies that the social costs of delayed implementation of VG-GATB are also very substantial. My proposed compromise solution to resolve the ethical and legal problems of within-group scoring is the Combined Rule Referral Plan. Chapter 5 examines long term policy goals and concludes the goal of creating incentives for hard study requires that accomplishments in school shold be one of the factors used to refer young job seekers to potential job openings. Chapter 6 lays out a plan of action for test development and validity research and proposes a redesign of the Employment Services system for referring job seekers to job openings.

Policy advice is sprinkled throughout the document and is identified by being printed in **boldface**. In order to assist the reader in understanding how the policy implications have been derived from the data presented and the literature reviewed, summary statements of findings are presented in *italics*.

Chapter 1

Greater use of tests assessing competence in verbal, mathematical, technical arenas and in specific occupations for selecting workers will have important effects on the economy. First, the rewards for developing the competencies measured by the tests will rise and this will increase the supply of workers with these competencies. Tests like the General Aptitude Test Battery (GATB) predict job performance because they measure or are correlated with a large set of developed abilities which are causally related to productivity and not because they are correlated with an inherited ability to learn. Legal barriers to increased use of tests assessing verbal, mathematical and

technical competence have contributed to our society's tendency to under-rewards these achievements. The resulting weak incentives for hard study have contributed to the low levels of achievement of American high school students in science and mathematics.

Chapter 2

The chapter recommends that the Department of Labor should expand its use of occupational competency assessments that incorporate a performance component such as the assessments made available by the National Occupational Competency Testing Institute (NOCTI) to help market training program graduates, to encourage the spread of competency based education and to improve program accountability. *Meta-analyses of the hundreds of studies of the validity of occupational competency tests have found that content valid occupational competency tests are highly valid predictors of job performance. When tests appropriate to the job compete with academic ability tests to predict job performance, the occupational competency tests have about twice as large an effect as ability tests (Hunter, 1983). Since large improvements in job knowledge are easier to achieve than equivalent (in proportions of a standard deviation) improvements in verbal and mathematical skills, occupationally specific training would appear to be highly desireable if the student is likely to put the knowledge to use by working in the occupation.*

One of the major benefits of using occupational competency testing to evaluate programs is the diagnostic information that analysis of the test results for individual performance objectives gives teachers and curriculum developers. When accountability systems based on training related placement rates and/or earnings gains (estimated from UI wage record data) signal that an individual program is performing poorly, they do not offer program operators a diagnosis of what is wrong. If placement rates are low, the natural tendency is to redouble placement efforts. While high school vocational education should increase its emphasis on placement into high wage jobs, there is a danger of overdoing this emphasis. If labor market outcomes are the only performance indicators, the placement director may be the only one made "accountable" by the system. The labor market is not so efficient that programs that do a good job of teaching will inevitably find it possible to place their graduates in training-related jobs that pay good wages.

Whenever possible the Employment Service (ES) should use occupational competency tests to refer job candidates to jobs listed at the ES. Many ES clients have expertise in an occupation for which validated occupational competency exams (eg. a NOCTI exam) are available. If there are (or are likely to be) job openings in the local labor market in this occupation, the client should be offered the opportunity to take the occupational competency exam as a way of signalling their level of competence to prospective employers. Giving priority to occupational competency tests not only maximizes the expected productivity of the individuals referred to a particular job; it also maximizes classification efficiency--the assignment of job seekers to jobs which make use of already acquired skills. If new hires will shortly be promoted into higher level jobs, the job knowledge test should also cover the skills required in these jobs.

When a job can be learned very rapidly and at low cost, the gain from hiring on the basis of occupation specific skills may be small. If the skills are highly specific to the firm, it also may

make little sense to look for already trained workers. In both cases qualities other than occupation specific skills such as dependability, adaptability, verbal and mathematical competence and an ability to learn may be a more important consideration in hiring decisions. Consequently, occupation specific competency exams can never be the sole basis for an ES referral system. If the ES is to serve people who have no previous occupational training and experience or who desire to change occupations, a method needs to be developed for predicting the future job performance of individuals who currently have no training or experience in the field.

Chapter 3

Military and civilian studies of the impact of verbal, mathematical and technical competence on job performance were reviewed. It was concluded that different occupations tap different abilities. Tests of mechanical comprehension and generic technical knowledge are excellent predictors of job performance in technical and blue collar jobs but not in clerical and sales jobs. Verbal skills have little importance in craft and other blue collar jobs but ar very important in clerical jobs. Research conducted in the military has found that a test of competence in algebra and geometry is a better predictor of job performance than arithmetic computation tests or arithmetic problem solving tests. I conclude from this evidence that:

1) Tests assessing competence in the technical arena should be added to the GATB.
2) A test assessing knowledge of algebra and geometry should be added to the GATB.
3) The Employment Service should attempt to refer people to jobs in a way that maximizes their comparative advantage. Maximum validity and maximum classification efficiency requires a larger set of job families within which validity is presumed to generalize and a larger array of distinct academic competencies are assumed to influence job performance differentially in different occupations. G is not a concept that usefully applies to a job referral system.
4) Separate performance prediction models need to be estimated for clerical, sales and for blue collar jobs of the same complexity.

The resulting system would look much like the job assignment system currently in use by the armed forces--a system that has no doubt contributed to the professionalism that American troops have exhibited in the Persian Gulf.

The analysis of GATB revalidation data conducted for this paper found that age and previous occupational experience had extremely large effects on job performance. The productivity gain from hiring a worker with 5 years of occupational experience in the field is substantially larger than the gain from hiring a worker with one population standard deviation (about 5 grade level equivalents) higher in verbal and mathematical ability. McDaniel, Schmidt and Hunter's (1988) meta analysis supports this conclusion. They found that ratings of experience using the behavioral consistency method had the greatest validity. Consequently, it is very important that ES referrals be based on previous experience in the occupation (or a closely related one) and the total amount of work experience as well as aptitude test scores. The referral system in place prior to VG-GATB was built almost entirely around matching the workers specific skills and experience to the specific needs of employers. In its initial conception, the VG-GATB system was not going to take previous occupational experience into account in the referral process (Hawk et al. 1986). Employers were, however, allowed to specify a minimum level of occupational experience requirement to be used as a screening criterion prior to the implementation of the GATB referral process and almost all employers chose to do so.

There are two good reasons, however, why occupational experience assessment should also be a part of the VG-GATB system. First, ignoring specific occupational experience when making referrals reduces classification efficiency and the overall validity of the system. Quite often, the work experience screening criterion selected by the employer will leave a large pool of eligibles most of whom have no relevant occupational experience but some that do. When it comes to making the referral, the ES clients who have considerable experience in the occupation will not be any more likely to be referred. GATB test scores will determine which applicant gets interviewed and the employer will never have a chance to make a decision to give the workers previous relevant experience positive weight. Second, incorporating work experience in the ranking algorithm for making referrals substantially improves the face validity and fairness of the referral system. I think that most of the public will view a referral system based solely on test scores and which ignores measurable differences in relevant occupational experience as unfair to older workers.

Chapter 4

Greater use of tests like the GATB to select workers will also change the sorting of workers across jobs. Its impacts on total output depends on the extent to which the developed abilities measured by employment tests--academic achievement, perceptual speed and psychomotor skills-- have larger impacts on worker productivity in dollars in some occupations than in others. This question is examined by analyzing GATB revalidation data on 31,399 workers in 159 occupations and by reviewing the literature on how the standard deviation of worker productivity varies across occupations. The analysis finds that indeed such differentials exist and therefore that reassigning workers with demonstrated verbal and mathematical competence to occupations where the payoff to the talent is particularly high will increase aggregate output. The magnitude of the output effect was estimated by reweighting the GATB revalidation data to be representative of the 71 million workers in the non-professional and non-managerial occupations and then simulating various resorting scenarios. An upper bound estimate of the productivity benefits of reassigning workers on the basis of three GATB composites is that it would raise output by $111 billion or 6.9 percent of compensation. Reassignment based solely on tests and previous occupational experience (with no affirmative action allowed) raises the wages of Blacks and Hispanics slightly but reduces their numbers in technical and craft jobs. Women are the big gainers. Occupational segregation of women is greatly reduced and their wages increase 15 percent.

I conclude, therefore, that greater use of employment tests for selection would generate very large social benefits. The simulations imply that the undiscounted cost of a one year delay in the wide-spread adoption of selection systems based on work experience and aptitude tests is probably more than $60,000,000,000. Consequently, it is very important to settle the legal and political controversy over the adverse impact/racial preference issue as speedily as possible so that the ES may resume the use of the GATB in making job referrals.

The political and legal controversy over within group scoring appears to have caused the Department of Labor to reject the National Academy's advise and to propose instead a two year moratorium on the use of the GATB while research is conducted which it is hoped will resolve the controversy (Department of Labor, July 24, 1990). This is a false hope. The issue must be decided on political, legal and ethical grounds, not scientific grounds. No amount of scientific research or further development work on the GATB can make the dilemma go away. The proposals for improvements in the VG-GATB job referral system made in Chapter 5 and 6 would reduce adverse impact, but it does not eliminate it.

The dilemma arises from the fact that competence in reading, writing, mathematics and problem solving make people more productive. One would have to search long and hard to find a well paying attractive job for which this statement is not correct. Sadly, educational

achievement of Black and Hispanic minorities is not on average as strong as it is for the remainder of the population. The gap is closing but significant mean differentials remain and this puts minorities at a competitive disadvantage in the labor market. The conclusion of the National Academy report (1989) was:

> *The use of a regression equation based on the combined group of black and nonminority workers would generally not give predictions that are biased against blacks. Insofar as the total-group equation gives systematically different predictions, it is somewhat more likely to overpredict the performance of blacks than to underpredict (p. 253).*

In other words, the predictions these systems make that members of minority groups who receive low scores on tests assessing verbal and mathematical competence will be less productive on the job are on average correct. <u>If it is administered in a color blind manner,</u> any system which uses employment aptitude tests to select new hires will result in minority group workers being less prevalent in the higher paying more prestigious jobs where these competencies are needed the most. This should not surprise anyone, this is also the outcome of the current non test based system of selecting workers. It is also the consequence of selecting new hires on the basis of interviews, job knowledge tests, performance assessments such as typing speed, previous work experience, and reasons for leaving previous jobs. With respect to their effects on the advancement of minorities, the differences between selection methods are only matters of degree not of kind or of principle. Thus, the dilemma is not caused by the use of employment tests, it is caused by the desire to hire the most productive worker possible. If an employer's right to use colorblind assessment instruments to select the most qualified worker that can be found is to be preserved, the only way out of the dilemma is to redouble efforts to improve the skills of minority workers by offering job training and upgrading the quality of the schools serving minority children.

The Employment Service is not in a position where it can resolve the conflict between the competing goals of hiring individuals with the highest predicted productivity and affirmatively acting to improve the status of minorities. The Employment Service cannot force companies to hire the individuals it refers. It is only one of many labor market intermediaries and it loses market share if its referrals are unsatisfactory. Title VII of the Civil Rights Act and the executive order requiring affirmative action apply first and foremost to firms. There is a good reason for this. Employment Service referrals are typically only a portion of the applicants considered for a job. Adverse impact is determined by looking at the establishment's overall hiring and employment patterns not at the racial breakdown of one particular stream of job applicants. The fact that the Employment Service sent the job applicants should not and does not necessarily mean the firm has met its EEO obligations.

The Employment Service has been trying to facilitate the affirmative action efforts of private firms for decades. Within group scoring of VG-GATB was preceded by SATB decision rules which had the same effect. I suggest that one of the reasons why this has now become such a contentious issue is that the decision made with respect to ES referral policy will be seen as a precedent for the how Title VII and the Uniform Guidelines will be applied to firms. The National Academy Committee on the General Aptitude Test Battery made, in my opinion, a serious error in letting the issue be framed this way. The result has been a political stalemate and everyone has been made worse off by the reduction in the nation's productivity that has resulted from the delay in the implementing VG-GATB.

A compromise is needed. The Combined Rules Referral Plan recommended by the National Academy's Committee on the General Aptitude Test Battery is, in my view, the best solution (1990, p. 271). Under this plan employers would receive three candidates per opening chosen by a ranking algorithm that takes no account of race or gender and up to three additional referrals of minority applicants. Information on the unadjusted test scores would be given to the employer.

> The attraction of this approach is that it places responsibility for the composition of the work force with the employer....The Job Service is not placed in the position of appearing to relieve the employer of these decisions, an implication that some employers seem to have drawn from the VG-GATB system of referral based only on within-group scores (1989 p. 273).

The ES would simply be doing its best to encourage employers to pursue the "cast a wider net" version of affirmative action. This form of affirmative action says to employers "You are not expected to change your policy of hiring the best possible job candidate, but please expand your recruitment efforts so as to attract additional minority group members into your applicant pool." This type of affirmative action has seldom been controversial.

Chapter 5

The findings presented in the first four chapters of the report imply that improved signaling of worker skills and competencies to employers will have significant positive effects on productivity and standards of living. Productivity gains occur both because more valid selection procedures improve the match between workers and jobs and because the supply of workers with the talents measured by the tests or school examinations grows in response to the increase in labor market rewards for the talents. Adverse impacts on blacks and Hispanics can be avoided by affirmative action and using the Combined Rules Referral Plan proposed by the National Academy's Committee on the GATB. Consequently, impacts on minority groups should not be the basis for deciding whether to use an employment test or which test to use. Other instruments are available for achieving employer and societal goals regarding integration on the job and the representativeness of a firm's workforce. When, however, it comes to generating incentives to develop the skills needed on the job and efficient matching of workers with talents to jobs, there appears to be no other selection instrument that will sort efficiently while generating the correct incentives quite as well as measures of verbal, mathematical and technical competence. These are the two criteria--incentives and sorting efficiency--by which alternative employee selection policies should be evaluated. That is the task undertaken in this chapter.

Sorting efficiency will tend to be maximized when the employment tests used in selection for a particular occupation measure developed abilities which have a uniquely high productivity payoff in that occupation (eg. mechanical comprehension for maintenance and repair occupation). In other words, selection/classification protocols should attempt to encourage workers to enter occupations in which they have a comparative advantage. Tests should be used but they should supplement not displace consideration of other factors such as personality, physical strength and occupationally relevant training and experience. If most of the people hired into an entry job move up to other more responsible positions, the criteria applied at the port of entry needs to take the higher level jobs into account.

The analysis presented in chapter 1 implies that student incentives to learn and parental incentives to demand a quality education are maximized when the following is true: (1) significant economic rewards depend directly and visibly on academic accomplishments, (2) the accomplishment is defined relative to an externally imposed standard of achievement and not relative to one's classmates, (3) the reward is received immediately, (4) everyone, including those who begin high

school with serious academic deficiencies, has an <u>achievable goal</u> which will generate a significant reward and (5) progress toward the goal can be monitored by the student, parents and teacher.

One of the saddest consequences of the lack of signals of achievement in high school is that employers with good jobs offering training and job security are unwilling to take the risk of hiring a recent high school graduate. They prefer to hire workers with many years of work experience. One important reason for this policy is that the applicant's work record serves as a signal of competence and reliability that help the employer identify who is most qualified. In the US recent high school graduates have no such record and information on the student's high school performance is not available, so the entire graduating class appears to employers as one undifferentiated mass of unskilled and undisciplined workers. Their view of 18 year olds was expressed by a supervisor at New York Life Insurance who commented on television "When kids come out of high school, they think the world owes them a living" (PBS, March 27, 1989). Surely this generalization does not apply to every graduate, but the students who are disciplined and academically well prepared currently have no way of signaling this fact to employers.

Reacting to these concerns the Secretary of Labor's Commission on Workforce Quality and Labor Market Efficiency made the following recommendations:

> The business community should...show through their hiring and promotion decisions that academic achievements will be rewarded (p. 9).

> High-school students who excel in science and mathematics should be rewarded with business internships or grants for further study (p. 11).

> Schools should develop easily understood transcripts which at the request of students, are readily available to employers. These transcripts should contain documentable measures of achievement in a variety of fields as well as attendance records. State governments should provide assistance to facilitate the standardization of transcripts so that they will be more easily understood. (1989, p. 12)

Competency should be defined by an absolute standard in the way Scout merit badges are. Different types and levels of competency need to be certified. Minimum competency tests for receiving a high school diploma do not satisfy the need for better signals of achievement in high school. Some students arrive in high school so far behind, and the consequences of not getting a diploma are so severe, we have not been willing to set the minimum competency standard very high. Once they satisfy the minimum, many students stop putting effort into their academic courses. What is needed is a more informative credential which signals the full range of student achievements (e.g. statewide achievement exam scores, competency check lists).

It is therefore, desireable for American school systems to sponsor tests of competency and knowledge that are specific to the curriculum being studied (e.g. New York State's Regents Examinations, NOCTI's Student Occupational Competency Achievement Tests) and then to provide students with competency profiles certifying capabilities and for the Employment Service to incorporate these signals of accomplishment into its system of referring young workers to jobs.

This approach to signaling academic achievement to the labor market has a number of

advantages over expanded GATB style testing. Because it is centralized and students take the exam only once, job applicants do not have to take a different exam at each firm they apply to and the quality and comprehensiveness of the test can be much greater. There is no need for multiple versions of the same test and it is much easier to keep the test secure. By retaining control of exam content, educators and the public influence the kinds of academic achievement that are rewarded by the labor market. Societal decisions regarding the curriculum (eg. all students should read Shakespeare's plays and understand the Constitution) tend to be reinforced by employer hiring decisions. Tests developed solely for employee selection purposes would probably place less emphasis on Shakespeare and the Constitution.

Chapter 6

Occupational Competency Assessment: The federal government's heavy investment in the development of systems of occupational competency assessment (OCA) for military jobs contributed substantially to professionalism of the soldiers in the Persian Gulf. Similar benefits can be obtained by improving the quality of occupational competency assessments for civilian jobs. As the role of occupational competency assessment in program accountability and competency certification of trainees grows, it is important for the Department of Labor to shoulder responsibility for rationalizing and improving the instruments used to make these assessments. The most urgent need is to improve the security and up-to-dateness of occupational competency assessments. This would be accomplished by revising the OCAs on a regular basis and generating 3 or 4 alternative forms of an OCA when a revision is made. Consideration should also be given to developing modular tests. I propose that DOL consider funding the development of a set of more generic competency tests that would cover the skills that are common to an entire industry (eg construction or retailing) or occupational family (clerical work). These assessments should have a hands-on performance component. IRT testing technology should be used to develop these tests. This makes it easier to develop additional forms of the test and to drop items that become obsolete and add new items that reflect changes in skill needs and curriculum.

Developing and Validating a New Expanded GATB: VG-GATB is a valid and effective way of referring applicants to employers. Important efficiency gains are possible, however, from a modified VG-GATB referral system based on occupational competency assessments, ratings of work experience, other biodata and an expanded GATB. Developing this new referral system will require a major expansion of the Employment Services's program of test development and validity research. The research program would develop a new GATB based on IRT technology and increased use of constructed response questions whose cognitive component would resemble broad spectrum achievement test batteries such as the ASVAB.

I recommend that studies be conducted of the ability of the adult literacy tests originally developed for the National Assessment of Educational Progress (NAEP) to predict job performance and retention and promotions on the job. I predict that these tests will be more valid predictors of job performance than the cognitive component of the current GATB. If they are at least equally valid, I recommend that these tests be substituted for the mathematical and verbal sections of the GATB. The NAEP/DOL Adult Literacy tests are a good choice because they:
* Have high face validity,
* Measure developed competency not aptitude and this is considered more just,
* Document literacy appears to be highly relevant yet is not available elsewhere,
* The authenticity of the competencies assessed means we need not be concerned about teachers to adjust their teaching to insure this material is covered.
* Use a constructed response format and have high content validity
* Four group administered alternative forms of this test have already been developed.

This use of IRT technology to develop three slightly different versions of the same instrument, two under government control and one in the hands of a private publishing concern, is a model of how DOL should make the results of future test development efforts available to the general public.

Employment service clients seeking typing or secretarial jobs would be expected to take the newly developed typing test. Those seeking jobs involving the use of a computer would be offered the opportunity to take a computer literacy test. Those intending to work in technical, craft or operative occupations would be encouraged to take either the science test or a technology test. The science test might be derived from the NAEP science assessment. The technology test should be similar to the technology subtests of the Armed Service Vocational Aptitude Battery (ASVAB). By employing the latest computerized adaptive IRT testing technology, it will be possible to get reliable estimates of the individual's capability in a large number of domains in a reasonably short period of time. A biodata form similar to the one being developed by Office of Personnel Management focussing on measuring affective traits, specific skills, occupation specific work experience and accomplishments in school would also need to be developed.

The design of the expanded VG-GATB system should not await new validity research. Meta analyses of past studies, careful examination of the findings of the massive study of selection and classification being conducted by the military, content analysis and the professional judgments of industrial psychologists, economists, management consultants and employers can produce an initial design for the system. Content validity is a powerful tool that was underutilized in the design of the VG-GATB system. The components of the system--the tests, competency assessments and biodata forms--would be obtained either by adopting existing instruments, modifying existing instruments or by contracting for a newly developed instrument.

A blue ribbon advisory committee would advise the Employment Service and the Secretary of Labor regarding how these components should be integrated with each other. As soon as these decisions are made an outside contractor would be hired to work closely with the Employment Service to develop explanatory materials, computer software and training manuals and to provide training for local office staff. As soon as the training materials are ready, the new system would then be implemented in as many states as are interested. Contracts would be let to outside organizations to evaluate the experience with the new system in the sites where it is first implemented.

ES referral policies should not be frozen while the new system is being developed and introduced. It makes no sense at all to stop pilot site use of VG-GATB on the grounds that more research is needed. This stops the refinement and learning process that is under way at these sites and makes it harder to recruit employers to participate in ES validation research. Much has already been learned from VG-GATB's pilot phase. We learned, for example, that employers wanted the Employment Service to continue to take specific skills and work experience into account when making referrals. Much more can be learned by studying the cumulating experience with VG-GATB.

Experience in operating the evolving VG-GATB system will in fact be one of the primary teachers. As findings accumulate ad hoc modifications would be made to the modified VG-GATB system described in the next section. The research program would be a continuous

process of refinement, updating and improvement.

Predictive Validity Studies to Refine the System: The second element of the research program involves predictive validity studies of the newly developed instruments and the revised VG-GATB system. This research would be conducted simultaneously with the implementation of the new system. The objective would be to collect validity data on 300 workers in 100 different occupations each year for at least the next ten years. Criterion data should be expanded to include wage rates, absenteeism, turnover intentions, employee suggestions for increasing sales or improving productivity and ratings of the employee's ability to work well as part of a team and to favorably impress customers and suppliers. Prospective validity studies would be needed to refine and empirically validate instruments measuring domain specific knowledge (eg. electronics, auto mechanics). Prospective studies would also make possible an expansion of the criterion domain. Models should be estimated predicting quit rates, dismissal rates, promotion outcomes as well as performance ratings.

The USES has demonstrated that it can conduct high quality validity research at remarkably low cost. The research budget is currently so small (only about 5 million dollars), however, that a large proportionate increase will be necessary. This does not create administrative problems, however, because the same basic research design would be replicated in many different occupations and much of the money would be transferred to the states to be spent on data collection. A substantial increase in ES research staff will be required, however, if the target of studying 100 occupations per year is to be met. I recommend that the agency be immediately authorized to hire 20 additional PhD industrial psychologists (10 new PhDs and 10 IPAs with at least 6 years of professional experience). The primary constraint on the scale of this research effort is research sites not ES research staff. Workers and supervisors must be paid while they are filling out questionnaires and taking tests, and these costs sometimes make it difficult to recruit employers to participate. To facilitate ES access, employer organizations should be asked to co-sponsor the studies.

The Federal Role: The traditional role of government in the development of employment testing has been in funding and directing research and development. The primary application of the knowledge generated by this R&D program has been to the selection, assignment and training of the armed forces. There is probably no large organization in the world where testing has become such a pervasive part of recruitment, selection, training and management. The sophisticated use of competency and aptitude testing by the US military is one of the reasons why it has performed so effectively in the Persian Gulf. The second objective of R&D in this area has been the development of improved ES referral systems. This civilian research program has been drastically under funded, however.

Fear of litigation has significantly inhibited testing research outside of government. Companies no longer share the results of their validity studies or allow them to be published (even when the company's name is withheld) for fear of revealing their defense strategy to a potential litigant. As a result, research on alternatives to the GATB and the ASVAB has been inhibited. The government must step into the vacuum it has created and sponsor a major increase in research into the development and validation of improved employment tests. The results of the research should be published and versions of the instruments developed should be made available through private publishers. The protocols and computer programs used in implementing the Expanded VG-GATB system should be available for license.

Is Top Down Referral Optimal?: *The Employment Service has multiple constituencies: different types of job applicants, employers and the voting public. How is it to balance the interests of its various constituencies? The employment service has always been in the situation of having*

fewer employer requests for referrals than clients seeking jobs. During the 1950s and early 1960s, it took the position that it could best serve job seekers as a whole by sending employers the best possible applicants.

> *The standard practice up to [the mid 1960s] had been for a personnel representative in a firm to call a local office staff member with whom they had worked in the past, place a job order, and be confident that the local office staff person would only refer individuals in accordance with the employer's hiring requirements (Stevens 1988, p. 30).*

During this period ES referrals accounted for nearly 20 percent of the nation's new hires. Priorities shifted in the mid 1960s and the ES "became one of the Nation's public advocacy weapons for affirmative action on behalf of targeted populations":

> *In the mid-1960s local office procedures were modified in several ways. First, discriminatory referral procedures, which had always been frowned upon, were now more actively discouraged. And second, individual staff member control of job orders began to decline, which meant that the one-on-one relationships between employer representatives and State Employment Security Agency staff members were weakened. Both of these challenged the ability of the local office to offer a continuing guarantee of screening reliability. Many observers attribute the growth of private employment agencies coincident with the stagnation of the public employment service system to this social responsibility of the public agencies (Stevens, 1988, p. 30).*

Funding formulas were skewed to emphasize placement of targeted groups rather than total placements. The Employment Service's market share fell to about 8 percent of new hires in 1971. It remained low throughout the 70s and 80s and in 1987 was about 7 percent (Cohen and Stevens, 1989). The result is that in 1987/88 it placed only 17.5 percent of the 18,439,000 people who requested help in seeking work. In addition, the quality of the positions for which it obtained job orders deteriorated. For a labor market intermediary to succeed:

> *Employers must have confidence in the ability and willingness of the labor exchange broker to conduct the appropriate screening function, and the job seeker must also have confidence that they will be made aware of appropriate opportunities through the broker's auspices (Stevens 1988, p. 31).*

By 1983 employer attitudes toward the ES had deteriorated to such an extent that most employers did not want to receive referrals of workers eligible for TJTC tax credits worth nearly 50 percent of the wage if the referral was to come from the Employment Service (Bishop 1987). The Employment Service lost much of its middle class constituency and was, consequently, unable to fend off substantial budget cuts during the most severe recession since World War II. The very high priority placed on serving one particular constituency resulted over time in the agency losing the support of other constituencies: employers, voters, and nondisadvantaged workers. Since they control the scarcest element of the job matching process, job openings, employer disillusionment was particularly damaging. The agency even began to lose its ability to serve the disadvantaged.

VG-GATB and, in particular, office wide implementation of VG-GATB represents an effort to remake the reputation of the Employment Service and to return at least part way to the philosophy that prevailed in the 1950s and early 1960s--that of honest broker. **This, I feel, should be the**

primary goal and role of a job matching service. In the computer age, there are substantial economies of scale in the labor exchange function. The Employment Service should seek to improve the matching of all workers to all jobs. Achieving this goal will require that the ES greatly expand the number of employers for which it provides referral services.

What should office wide implementation of an expanded VG-GATB system look like? With only a few exceptions, all ES registrants should complete computerized general and occupation specific biodata instruments. The applicant would also specify the types of jobs he/she would like to be referred to and provide (on a confidential basis) his/her minimum acceptable wage. Individuals who want to compete on the basis of a typing test or an occupational competency test would take the appropriate test and referrals would be based on some combination of biodata and test results. Otherwise, the individual would be encouraged (but not required) to take the expanded VG-GATB battery and referrals would be based on some combination of biodata and GATB subtest scores. Individuals who choose neither of the test based options would be referred on the basis of biodata alone. Employers seeking referrals would specify which of the three types of screening they prefer. Employers requesting screening on the basis of occupational competency tests would have first crack at the pool of applicants. Employers desiring screening on the basis of occupationally specific skills, training and experience (either solely or in combination with GATB test scores) would have second crack. Employers not seeking occupation specific skills but seeking high GATB test scores would have third crack at the pool. Within these categories, firms offering the higher compensation during the first few years on the job would be serviced first.

The priorities are an effort to avoid referring highly skilled workers to jobs which do not make use of their skills. It is also intended to result in the higher wage firms being able to attract the more qualified workers. It is not likely to be completely successful, however. Since the stock of applicants will be much larger than the flow of job orders, the system will have a tendency to operate on a first come first serve basis. Employers, even low wage employers, would have referred to them the most qualified applicants in the system at the time they enter their job order. This is probably not the optimal sorting/referral algorithm. It will generally be desireable for applicants who are highly qualified in a particular field to limit their search for a while to jobs which make full use of their skills and then broaden the search to lower paying jobs which make lesser use their skills only when the first effort is clearly not yielding fruit. Probably the best way to accomplish this is to encourage applicants to specify a minimum acceptable wage which declines as time passes.

Referring high skilled workers to low skill jobs may be counterproductive. Prior to making a referral, the ES should have good reason to believe that the applicant will probably accept the job if offered and not quit as soon as something better comes along. Probability of turnover, is thus another factor that needs to be considered when making referral decisions. Some careful thought needs to be given to these issues and I recommend that the ES fund studies of the turnover of ES referrals and more than one simulation study of the consequences of different sorting/referral algorithms. While the high-skill-high-wage firms in a community should clearly receive top-down referral service from the ES, it is not self evident that low skill high turnover firms should have essentially equal priority to top-down referrals based on GATB test scores (constrained only by job seeker reservation wages and occupation preferences).

The danger that many see in a fully implemented VG-GATB system is that all employers will choose to receive top-down referrals and ask that their opening not be revealed to other registrants. The workers with high GATB scores will be quickly snapped up and those with low test scores will languish indefinitely in the pool of registrants not even receiving

referrals to low skill low wage jobs. As additional job orders flow into the ES, the reservoir of high test score individuals would become depleted. Employer disillusionment with the ES might return, shutting off the growth of job orders before a reasonable balance has been achieved between the flow of applicants and of job orders. The new equilibrium market share would be higher than it is now, but the ES would no longer be providing referral assistance to the low-skill-low-test-score job seekers. These individuals would have to make their own job contacts, probably through a job club arrangement.

If the ES is to maximize its market share and to serve its multiple constituencies, it must somehow forestall this outcome. The best way to deal with this problem is to charge employers who request referrals on the basis of competency or GATB tests a fee of about $15.00 per referral to cover the costs of the testing. There would be no charge for referrals based on biodata alone and "cast a wider net" referrals. The fee would be set at a level designed to insure that at least 25 percent of the job orders received would not specify test based referral. The advantage of this approach is that it internalizes an externality generated by the common property character of the ES top-down referral pool. The situation is something like that of an over exploited fishery. The only alternative I see to differential fees, is the exclusion of certain categories of jobs from access to the top-down referral pool. I prefer the fee system because the decision about whether to access the top-down referral pool is left to the firm not to bureaucratic judgement or regulations.

TABLE OF CONTENTS

DEPARTMENT OF LABOR TESTING POLICY

The professionalism that the American military recently exhibited in the Persian Gulf is in no small part due to the care with which it selects, assigns and trains its soldiers. The military's success in preparing this highly skilled workforce was made possible by decades of research into occupational competency assessment, aptitude test development and validity research. The Department of Labor is also a world leader in the development and validation of employment aptitude tests and there is now an opportunity for this expertise to be implemented in ways that can enhance the nations's competitiveness and improve the standard of living of all of its workers. This paper describes how an Employment Service job referral system can be developed and implemented to achieve these objectives. It is organized into 6 Chapters.

Chapter 1 demonstrates that how workers are selected for jobs profoundly effects the rewards for developing the skills needed by the economy. If attractive jobs are more available to those who have certain skills, the supply of workers with these skills is likely to increase. Students will see a benefit to devoting more time and energy to their studies and parents will see a stronger connection between the quality of local schools and their child's career success.

The benefits of improving occupational competency assessment are reviewed in Chapter 2. Chapter 3 reviews the evidence from military and civilian studies on what predicts job performance. This analysis concludes that different jobs require different constellations of generic competencies, that technical competence in particular is a powerful predictor of job performance in bleu collar, craft and technical jobs. Relevant occupational work experience is also an extremely important determinant of performance. Chapter 4 calculates an estimate of the magnitude of the social benefits that would be generated by a major expansion in the use of VG-GATB for employee selection. The social benefits are found to be very large. This implies that the social costs of delayed implementation of VG-GATB are also very substantial. My proposed compromise solution to resolve the ethical and legal problems of within-group scoring is the Combined Rule Referral Plan. Chapters 5 examines long term policy goals and concludes the goal of creating incentives for hard study requires that accomplishments in school shold be one of the factors used to refer young job seekers to potential job openings. Chapter 6 lays out a plan of action for test development and validity research for the next decade.

Policy advice is sprinkled throughout the document and is identified by being printed in **boldface**. In order to assist the reader in understanding how the policy implications have been derived from the data presented and the literature reviewed, summary statements of findings are presented in *italics*.

I. THE INCENTIVE EFFECTS OF HOW WE SELECT WORKERS FOR JOBS

*There is a professional consensus that employment tests measure **abilities, skills and habits** which must be developed and which are, therefore malleable.* This consensus was reflected in the 1982 National Academy report on employment testing:

> General ability or "intelligence" refers to a repertoire of information-processing skills and habits....These skills and habits must be developed.(p. 29)

> ...intelligence tests...is an unfortunate label. It is too easily misunderstood to mean that intelligence is a unitary ability, fixed in amount, unchanged over time, and for which individuals can be ranked on a single scale. (p.28)

> Achievement and aptitude tests are not fundamentally different. They both measure developed ability, they often use similar questions, and they have often been found to yield highly related results. Rather than two sharply different categories of tests, it is more useful to think of "aptitude" and "achievement" tests as falling along a continuum. (National Academy of Sciences Committee on Ability Testing, 1982 p. 27).

How malleable these abilities are depends on the nature of the skill and the power of the educational intervention. Evidence of the malleability of the skills measured by employment tests can be found in a variety of literatures. Adoption studies have found that children adopted by upper middle class parents have significantly higher IQ and academic achievement than the siblings who remain with their lower class parents (Schiff et al 1978, 1982, Dumaret 1985, Duyme 1985). Other studies have shown that scores on academic achievement tests improve over the course of the school year and then decline during the summer vacation (Heyns 1987), improve more rapidly for those in school than for drop outs (Husen 1951; Department of Labor 1970; Hotchkiss 1984) and improve more rapidly if the student pursues a rigorous college prep curriculum (Bishop 1985; Hotchkiss 1984). The important effects of environment on these developed abilities is also demonstrated by the upward trend of national mean scores on IQ tests (Tuddenham 1948; Flynn 1987), by the large fluctuations in scores on broad spectrum achievement tests (scores of Iowa seniors on the Iowa Test of Educational Development rose .58 standard deviations between 1942 and 1967 and then fell by .35 standard deviations between 1967 and 1979, Forsyth 1987) and by the rapidly closing gap between black and white achievement in National Assessment of Educational Progress data. In the early NAEP assessment's black high school seniors born between 1952 and 1957 were 6.7 grade level equivalents behind their white counterparts in science proficiency, 4 grade level equivalents behind in mathematics and 5.3 grade level equivalents behind in reading. The most recent National Assessment data for 1986 reveals that for blacks born in

1969, the gap has been cut to 5.6 grade level equivalents in science, 2.9 grade level equivalents in math and 2.6 grade level equivalents in reading (NAEP 1988, 1989). Koretz's (1986 Appendix E) analysis of data from state testing programs supports the NAEP findings.

Since the abilities measured by employment tests are malleable, it is important to take into account the effects of employment testing on the supply of skilled people. Greater use of tests measuring competence in reading and mathematics for selecting workers will increase the rewards for having these skills. This is likely to have two effects: students will devote more time and energy to developing these skills and parents will become more willing to pay higher taxes to achieve higher standards in their local schools. This judgement follows from four propositions which will be defended below:

1. The American labor market under-rewards the developed abilities measured by these tests. Even though academic achievement has substantial effects on worker productivity, most employers do not base hiring decisions on achievement in high school because grades are not comparable across high schools, transcripts are hard to obtain in a timely manner and administering employment tests risks costly litigation.

2. Young people would devote more time and energy to developing these abilities if the rewards were greater.

3. Parents would be more likely to demand higher standards of their local schools and to support the tax increases necessary to pay for better schools if their child's future depended more directly and visibly on how much is learned in high school.

4. The substantially better performance of European, Canadian, Australian and Asian secondary school students on international mathematics, science and geography exams results in part from the substantially greater economic rewards these societies give learning achievements in high school.

The first of these propositions is defended in the section 4.1. The labor market fails to appropriately reward effort and achievement in high school primarily because employers do not have access to reliable information on the academic effort and achievements of recent high school graduates. Section 4.2 addresses the second proposition by examining student incentives to study hard in high school. Section 4.3 analyzes incentives to upgrade local schools. Section 4.4 examines incentives to learn in Europe, Australia and Japan and concludes that labor market rewards for achievement in high school are much stronger in these societies than in the US; this is one of the reasons why their students study longer hours and learn much more math and science than American students.

1.1 THE ABSENCE OF MAJOR ECONOMIC REWARDS FOR EFFORT IN HIGH SCHOOL

The effort devoted to learning in high school and the actual competencies developed in high school are generally not well signaled to colleges and employers. Consequently, while students are generously rewarded for staying in school, the students who do not aspire to attend selective colleges benefit very little from working hard while in high school. This is in large measure a consequence of the failure of the labor market to reward effort and achievement in high school.
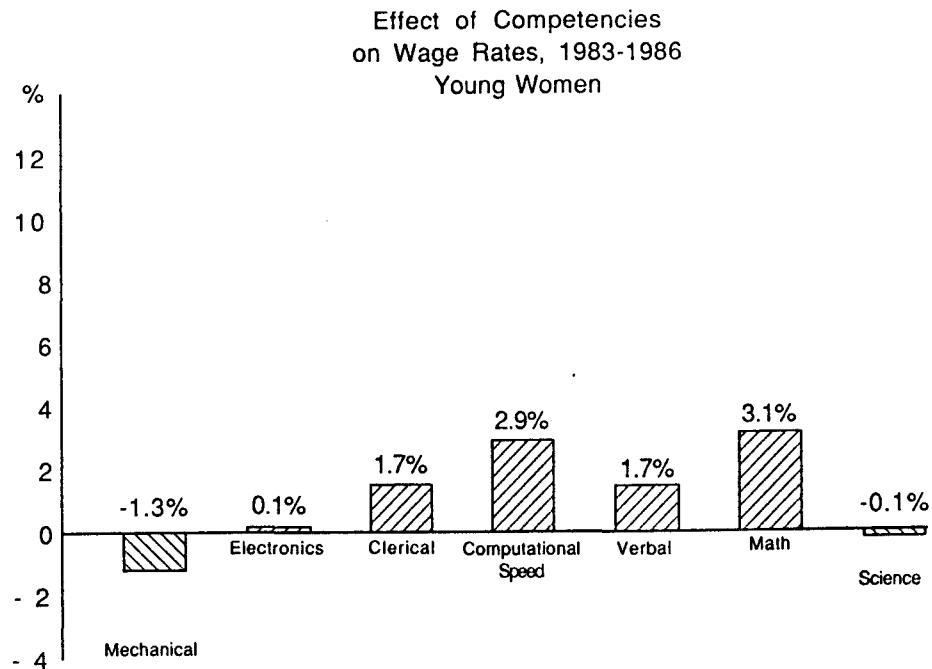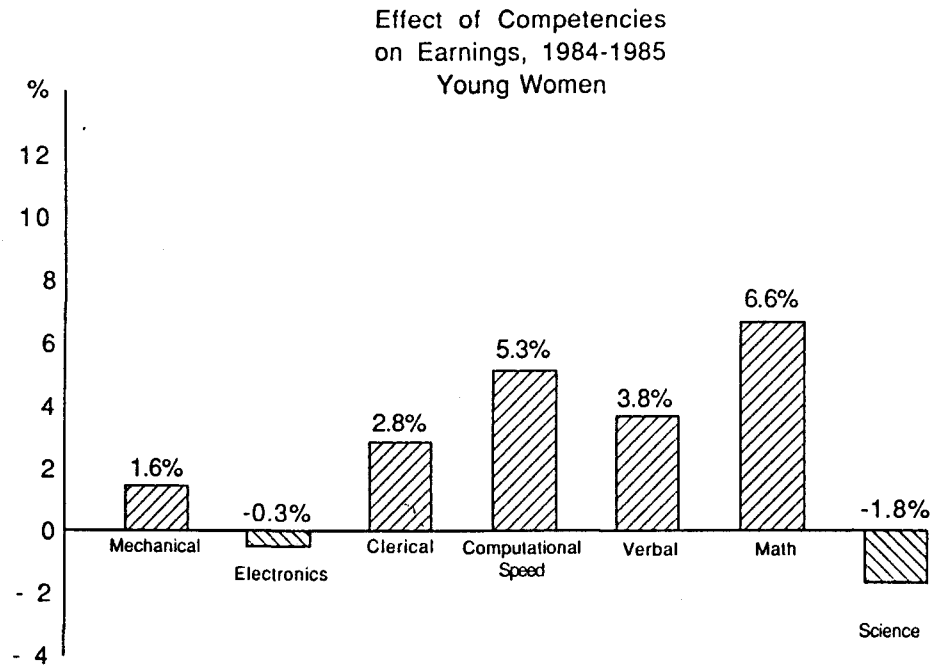
Students who plan to look for a job immediately after high school generally see very little connection between their academic studies and their future success in the labor market. When 10th graders were asked which math and science courses they needed "to take to qualify for their first choice of job", only 18 percent checked trigonometry or calculus, 20-23 percent checked physics, chemistry, biology and geometry and 29 percent checked algebra (Longitudinal Survey of American Youth 1988). Statistical studies of the youth labor market confirm their skepticism about the economic benefits of taking the more difficult courses and studying hard:

°   For high school students, high school grades and performance on academic achievement/aptitude tests have essentially no impact on labor market success. They have -

    --no effect on the chances of finding work when one is seeking it during high school, and
    --no effect on the wage rate of the jobs obtained while in high school.(Hotchkiss, Bishop and Gardner 1982)

°   For those who do not go to college full-time, high school grades and test scores had:
    --no effect on the wage rate of the jobs obtained immediately after high school in Kang and Bishop's (1985) analysis of High School and Beyond seniors and
    --only a 1 to 4.7 percent increase in wages per standard deviation (SD) improvement in test scores and grade point average in Meyer's (1982) analysis of Class of 1972 data.
    --a moderate effect on wage rates and earnings after 4 or 5 years. Gardner (1982) found an effect of 4.8 percent per SD of achievement and Meyer (1983) found an effect of 4.3 to 6.0 percent per SD of achievement,
    --a small effect on employment and earnings immediately after high school.

[Figure 1 and 2 about here]

°   Results of an analysis of the Youth Cohort of the National Longitudinal Survey are summarized in figures 1 and 2 (Bishop, 1988). It was found that during the first 10 years after leaving high school, young men received no rewards from the labor market for developing competence in science, language arts and mathematical reasoning. The only competencies that were rewarded were speed in doing simple computations (something that calculators do better than people) and technical competence (knowledge of mechanical principles, electronics, automobiles and shop tools). For the non-college bound female, there were both wage rate and earnings benefits to learning advanced mathematics but no benefits to developing competence in science or the technical arena. Competence in language arts

Figure 1

Effect of Competencies
on Earnings, 1984-1985
Young Women

Effect of Competencies
on Wage Rates, 1983-1986
Young Women

Source: Analysis of NLS Youth data. The figure reports the effect of a one population standard deviation increase in Armed Services Vocational Aptitude Battery subtest while controlling for schooling, school attendance, age, work experience, region, SMSA residence and ethnicity.

Figure 2

Effect of Competencies on Earnings, 1984-1985
Young Men

Effect of Competencies on Wage Rates, 1983-1986
Young Men

did not raise wage rates but it did reduce the incidence of unemployment among young women.

° In almost all entry-level jobs, wage rates reflect the level of the job not the worker's productivity. Thus, the employer immediately benefits from a worker's greater productivity. Cognitive abilities and productivity make promotion more likely, but it takes time for the imperfect sorting process to assign a particularly competent worker a job that fully uses that greater competence -- and pays accordingly.

The long delay before labor market rewards are received is important because most teenagers are "now" oriented, so benefits promised for 10 years in the future may have little influence on their decisions.

Although the economic benefits of higher achievement are quite modest for young workers and do not appear until long after graduation, we have seen that the benefits to the <u>employer</u> (and therefore, to national production) are immediately apparent in higher productivity. This implies that when a non-college-bound student works hard in school and improves his or her academic achievements the youth's employer benefits as well as the youth. The youth is more likely to find a job, but not one with an appreciably higher wage. In the next sub-section we explore the reasons for the discrepancy.

<u>Reasons for the Discrepancy between Wage Rates and Productivity on the Job</u>

Employers are presumably competing for better workers. Why doesn't competition result in much higher wages for those who achieve in high school and have strong basic skills? The cause appears to be the lack of objective information available to employers on applicant accomplishments, skills, and productivity.

A 1987 survey of a stratified random sample of small and medium sized employers who were members of the National Federation of Independent Business (NFIB) found that aptitude test scores had been obtained in only 2.9 percent of the hiring decisions studied (Bishop and Griffin, forthcoming). Top down hiring on the basis of test scores is even more unusual. Prior to 1971, employment testing was more common. The cause of this change was the fear of costly litigation over the business necessity and validity of employment tests. The EEOC's codification of the APA's professional testing standards and its theory of situational and subgroup differences in validity into federal law made the required validation studies so costly it discouraged almost all employers from undertaking the effort (Friedman and Williams 1982).

Other potential sources of information on effort and achievement in high school are transcripts and referrals from teachers who know the applicant. Both these means are under used.

In the NFIB survey, transcripts had been obtained prior to the selection decision for only 14.2 percent of the high school graduates hired. If a student or graduate gives written permission for a transcript to be sent to an employer, the Buckley amendment obligates the school to respond. Many high schools are not, however, responding to such requests. The experience of Nationwide Insurance, one of Columbus, Ohio's most respected employers, is probably representative of what happens in most communities. The company obtains permission to get high school records from all young people who interview for a job. It sent over 1,200 such signed requests to high schools in 1982 and received only 93 responses. Employers reported that colleges were much more responsive to transcript requests than high schools. High schools have apparently designed their systems for responding to requests for transcripts around the needs of college bound students not around the needs of the students who seek a job immediately after graduating.

There is an additional barrier to the use of high school transcripts in selecting new employees--when high schools do respond, it takes a great deal of time. For Nationwide Insurance the response almost invariably took more than 2 weeks. Given this time lag, if employers required transcripts prior to making hiring selections, a job offer could not be made until a month or so after an application had been received. Most jobs are filled much more rapidly than that. The 1982 NCRVE employer survey of employers found that 83.5 percent of all jobs were filled in less than a month, and 65 percent were filled in less than 2 weeks.

The school can help students get good jobs by developing an equitable and efficient policy for releasing student records. School officials have the dual responsibility of protecting the student's right to privacy and helping them find good, suitable jobs. The student and his or her parents should receive copies (encased in plastic) of transcripts and other records that might be released so that they may make them available to anyone they choose. Schools might also develop a sheet explaining to parents and students their rights, as well as the pros and cons of disclosing information.

According to the Federal Education Rights and Privacy Act, all that a student/graduate must do to have school records sent to a prospective employer is sign a form specifying the purpose of disclosure, which records are to be released, and who is to receive the records. The waiver and record request forms used by employers contain this information, so when such a request is received, the school is obliged to respond. Requiring that graduates fill out a school devised form--as one high school I visited did--results in the employer not getting the transcript requested and the graduate not getting the job. *There are probably millions of high school graduates who do not realize that they failed to get a job they were hoping for because their high school did not send*

the transcript that was requested. **Schools can best serve students by handling all inquiries expeditiously and without charge.**

The only information about school experiences requested by most employers is years of schooling, diplomas and certificates obtained, and area of specialization. Probably because of unreliable reporting and the threat of EEOC litigation, only 15 percent of the NFIB employers asked the applicants with 12 years of schooling to report their grade point average. Hiring on the basis of recommendations by high school teachers is also uncommon. In the NFIB survey, when a high school graduate was hired, the new hire had been referred or recommended by vocational teachers only 5.2 percent of the time and referred by someone else in the high school only 2.7 percent.

Consequently, hiring selections and starting wage rates often do not reflect the competencies and abilities students have developed in school. Instead, hiring decisions are based on observable characteristics (such as years of schooling and field of study) that serve as signals for the competencies the employer cannot observe directly. As a result, the worker's wage tends to reflect the average productivity of all workers with the same set of educational credentials rather than that individual's productivity or academic achievement. A study of how individual wage rates varied with initial job performance found that when people hired for the same or very similar jobs are compared, someone who is 20 % more productive than average is typically paid only 1.6 % more. After a year at a firm, better producers received only a 4% higher wage at nonunion firms with about 20 employees, and they had no wage advantage at unionized establishments with more than 100 employees or at nonunion establishments with more than 400 employees (Bishop, 1987a).

Employers have good reasons for not varying the wage rates of their employees in proportion to their perceived job performance. All feasible measures of individual productivity are unreliable and unstable. In most cases measurement must be subjective. Workers are risk averse and reluctant to accept jobs in which the judgement of one supervisor can result in a large wage decline in the second year on the job (Hashimoto and Yu 1980; Stiglitz 1974). Most productivity differentials are either specific to the firm or not visible to other employers, and this reduces the risk that not paying a particularly productive worker a comparably higher salary will result in her going elsewhere (Bishop, 1987a), Pay that is highly contingent on performance can also weaken cooperation and generate incentives to sabotage others (Lazear 1986). Finally, in unionized settings, the union's opposition to merit pay will often be decisive.

Despite their higher productivity, <u>young workers who have achieved in high school and who have done well on academic achievement tests do not receive higher wage rates immediately after</u>

high school. The student who works hard must wait many years to start really benefiting and even then the magnitude of the wage and earnings effect--a 1 to 2 percent increase in earnings per grade level equivalent on achievement tests--is considerably smaller than the actual change in productivity that results.

1.2 WILL LARGER ECONOMIC REWARDS FOR LEARNING INDUCE STUDENTS TO STUDY HARDER ?

Signals of learning such as years of schooling which are visible to all are handsomely rewarded and changes in these rewards have substantial effects on student enrollment decisions. When the payoff to a college degree for white males fell in the early 1970s, the college attendance rates of white males fell substantially (Freeman 1971, 1976a, 1976b). When the payoff to college rose again during the late 1970s and 1980s, male college attendance rates rose as well. Learning not certified by a credential is either not rewarded or only modestly rewarded. Consequently, there are strong incentives to stay in school; but much weaker incentives to study hard while in school. Students are quite aware that the labor market does not reward those who take more rigorous courses. As a result, less than a quarter of 10th graders believe that geometry, trigonometry, biology, chemistry or physics are needed to qualify for their first choice occupation (Longitudinal Survey of American Youth, 1988, BA24B-BA25D).

If students are to be motivated to devote more time and energy to learning, they must believe their effort will be rewarded. If parents are to be induced to demand better schools and to spend the time supervising homework, they too must believe that better teaching, a more rigorous curriculum and hard study produces learning which will be rewarded in the labor market. When, however, the only signals of learning accomplishment that are available--eg. GPA and rank in class--describe one's performance relative to close friends, the motivation to study and to demand better schools is undermined.

The Zero-Sum Nature of Academic Competition in High School

The second cause of the lack of motivation to learn is peer pressure against studying hard. Students report that "in most of the regular classes... If you raise your hand more than twice in a class, you are called a 'teachers pet.'" Its OK to be smart, you cannot help that. It is definitely not OK to study hard to get a good grade. An important reason for this peer pressure is that the academic side of school forces adolescents to compete against close friends. Their achievement is not being measured against an absolute or an external standard. In contrast to scout merit badges where recognition is given for achieving a fixed standard of competence, the only measures of

achievement that receive attention in American schools are measures of one's performance relative to one's close friends such as grades and rank in class. When students try hard and excel in school, they are making things <u>worse</u> for friends. Since greater effort by everyone cannot improve everyone's rank in class, the group interest is for everyone to take it easy. At that age peer friendships are all important, so informal pressure from the peer group is able to induce most students to take it easy. All work groups have ways of sanctioning "rate busters." High school students call them "brain geeks", "grade grubbers" and "brown nosers".

<u>The Consequences of Student Apathy</u>

Studies of time use and time on task in high school show that students actively engage in a learning activity for only about half the time they are scheduled to be in school (Frederick, Walberg and Rasher 1979). In the 1980 High School and Beyond Survey, high school students reported spending an average of only 3.5 hours per week on homework. When homework is added to engaged time at school, the total time devoted to study, instruction, and practice is only 20 hours per week. By comparison, the typical senior spent 10 hours per week in a part-time job and 24 hours watching television (A. C. Neilsen unpublished data). Thus, TV occupies more of an adolescents time than learning.

Even more important is the intensity of the student's involvement in the process. Theodore Sizer described American high school students as "**docile, compliant, and without initiative**" (Sizer 1984, p. 54). John Goodlad (1983) described "**a general picture of considerable passivity among students...** (p. 113)". The high school teachers surveyed by Goodlad ranked "lack of student interest" and "lack of parental interest" as the two most important problems in education. The student's lack of interest makes it very difficult for teachers to be demanding.

Some teachers are able to overcome the obstacles and induce their students to undertake hard learning tasks. But for most mortals the lassitude of the students is too demoralizing. In too many classrooms an implicit agreement prevails in which the students trade civility for lowered academic demands (Sizer 1984). Most students view the costs of studying hard as greater than the benefits, so they pressure the teacher to go easy. All too often teachers are forced to compromise their academic demands.

1.3 INCENTIVES TO UPGRADE LOCAL SCHOOLS

Students are not, however, the only group that is apathetic. Even though American children are far behind Taiwanese and Japanese children in mathematics capability, American mothers are much more pleased with the performance of their local schools than Taiwanese and Japanese

mothers. When asked "How good a job would you say ___'s school is doing this year educating___", 91 percent of American mothers responded "excellent" or "good" while only 42 percent of Taiwanese and 39 percent of Japanese parents were this positive (Stevenson 1983). Clearly, American parents hold their children and their schools to lower academic standards than Japanese and Taiwanese--as well as European -- parents.

The apathy of parents, school boards and local school administrators regarding the academic standards of local schools is another negative outcome of the absence of external standards for judging academic achievement and the resulting zero sum nature of academic competition in school. Parents can see that setting higher academic standards or hiring better teachers will not on average improve their child's rank in class or GPA. The Scholastic Aptitude Test does not assess knowledge and understanding of science, history, social science, trigonometry, statistics and calculus or the ability to write an essay. Consequently, improving the teaching of these subjects at the local high school will have only minor effects on how my child does on the SAT, so why worry about standards? In any case, doing well on the SAT matters only for those who aspire to attend a selective college. Most students plan to attend open entry public colleges which admit all high school graduates from the state with the requisite courses. Scholarships are awarded on the basis of financial need, not academic merit.

The parents of children not planning to go to college have an even weaker incentive to demand high standards at the local high school. They believe that what counts in the labor market is getting the diploma, not learning algebra. They can see that learning more will be of only modest benefit to their child's future, and that higher standards might put at risk what is really important--the diploma.

1.4 INCENTIVES TO LEARN IN OTHER NATIONS

The tendency to under-reward effort and learning in school appears to be a peculiarly American phenomenon. Grades in school are a crucial determinant of which employer a German youth apprentices with. In Canada, Australia, Japan, and Europe, educational systems administer achievement exams which are closely tied to the curriculum. Performance on these exams is the primary determinant of admission to a university and to a field of study. The resumes of recent secondary school graduates customarily contain a list of the examinations taken and the grade on each exam. Good grades on the toughest exams--physics, chemistry, advanced mathematics--carry particular weight with employers and universities.

In Japan, clerical, service and blue collar jobs at the best firms are available only to those

Left Column — Exhibit 1

NAME:

ADDRESS:

Exhibit 1

Resume of Irish
Secondary School Graduate

DATE OF BIRTH: · AGE:

NATIONALITY:

TELEPHONE NO:

EDUCATIONAL DETAILS

Primary School

Post Primary

Secretarial Course

Office Procedures
Course

EXAMINATIONS

Intermediate Certificate	198_	

SUBJECTS

Subject	Grade
English	B – L.C.
Irish	C – L.C.
Maths	B – L.C.
Science	C
Geography	C
History	C
Home Economics	D

Leaving Certificate	198_	

SUBJECTS

Subject	Grade
English	D – L.C.
Irish	C – L.C.
Maths	C – L.C.
Biology	C – H.C.
Geography	C – L.C.
French	D – L.C.
Home Economics	B – L.C.

Right Column — Exhibit 3

Exhibit 3

APPLICATION FOR AN APPOINTMENT HANDLED BY MVP

mvp

16, Highfield Road, Edgbaston, Birmingham, B15 3DU Tel: 021 455 9765/0559

United Kingdom   3_

Appointment applied for ... DISTRIBUTION PROJECTS MANAGER (3×Q) ... Ref.No. ....

PERSONAL DETAILS: (block capitals)

Surname .... Title MR Forenames ...... MERVYN JOHN

Address .... 7, CAERNARVON GARDENS ....

.... Postal Code .... Tel.No.Home .... Work ...

Marital Status ...... M ...... Children/Dependants (with ages) .... 1 × 4 YRS , 1 × 1 YR

Age ...... 33 ... Date of Birth 5.8.55 ... Nationality BRITISH ... Place of Birth ILFRACOMBE

State of health ...... OK ...... Height 6' Weight 13st

Any disabilities/recurrent medical problems? .... Regd.disabled ....

Driving Licences ...... CAR ...... Car Owner ...✓... Company Car ...

Endorsements, convictions, accidents, etc. .... NONE

Leisure activities and offices held in clubs and societies ... CYCLING/WALKING

EDUCATION:
Secondary Education

From	To	School	Exams Taken (inc. grades)	Other achi
1966	1972	BARNSTAPLE GRAMMAR	'O' LEVEL :– ENG. LANG. (2), MATHS (2) FRENCH (2) GEOGRAPHY (3), STATISTICS (3), CHEMISTRY (3). ADDL. MATHS (6), HISTORY (6), PHYSICS (6) 'A' LEVEL :– CHEMISTRY (E) PHYSICS (E), MATHS (O)	MIDDLE SCHOOL CAPTAIN

Further Education

From	To	College/University	Course & results (inc.class/grades)	Other achi
1972	1973	UNIVERSITY of BRADFORD	APPLIED CHEMISTRY – LEFT AFTER 1 YEAR – DOMESTIC REASONS	

Other training and qualifications (inc. in-company and external courses, etc.)

From	To	Establishment	Training/Qualifications
1979		FARSLEY COLLEGE, LEEDS	CERTIFICATE OF PROFESSIONAL COMPETENCE (TRANSPORT OPS)
1983	1984	CRANFIELD COLLEGE	INSTITUTE OF INDUSTRIAL MANAGEMENT CERT.
1984	1989	IN-COMPANY	NUMEROUS MANAGEMENT COURSES.

Membership of professional bodies

who are recommended by their high school. The most prestigious firms have long term arrangements with particular high schools to which they delegate the responsibility of selecting the new hire(s) for the firm. The criteria by which the high school is to make its selection is, by mutual agreement, grades and exam results. In addition, most employers administer their own battery of selection tests prior to hiring. The number of graduates that a high school is able to place in this way depends on its reputation and the company's past experience with graduates from the school. Schools know that they must be forthright in their recommendations because if they fail just once to make an honest recommendation, the relationship will be lost and their students will no longer be able to get jobs at that firm (Rosenbaum and Kariya 1987).

Japanese teenagers work extremely hard in high school, but once they enter college, many stop working. For students in non-technical fields a country club atmosphere prevails. The reason for the change in behavior is that when employers hire graduates with non-technical majors, they base their selections on the reputation of the university and a long series of interviews and not on teacher recommendations or other measures of academic achievement at the university. Students in engineering and other technical programs work much harder than their liberal arts counterparts largely because job opportunities depend entirely on the recommendation of their major professor. Studying hard is not a national character trait, it is a response to the way Japanese society rewards academic achievement.

Parents in Europe and Japan know that a child's future depends critically on how much is learned in secondary school. National and regional exams are the yardstick, so achievement tends to be measured relative to everyone else's in the nation or region and not just relative to the child's classmates. As a result, parents in most other Western nations demand more and get more from their local schools than we do and yet are, nevertheless, more dissatisfied with their schools than American parents. Students in other nations spend much less time watching TV: 60% less in Switzerland and 44% less in Canada (Organization of Economic Cooperation and Development, Table 18.1, 1986) and are much less likely to work part time during the school year. School years are longer. Japanese 5th graders spend 32.6 hours a week in academic activities while American youth devote only 19.6 hours to their studies (Stevenson, Lee and Stigler 1986). Forty-five percent of Japanese junior high school students attend Juku, private schools which provide tutoring in academic subjects (Leestma 1987). Thomas Rohlen has estimated that Japanese high school graduates average the equivalent of three more years in a classroom and studying than American graduates.

The greater effort yields greater achievement. In Stevenson, Lee and Stigler's (1986) study

of 5th grade math achievement, the best of the 20 classrooms sampled in Minneapolis was outstripped by every single classroom studied in Sendai, Japan and by 19 of the 20 classrooms studied in Taipeh, Taiwan. The nation's top high school students rank far behind much less elite samples of students in other countries. In math and science the gap between Japanese, English, Finnish and Canadian high school graduates and their white American counterparts is more than four US grade level equivalents.

In summary, the lack of true engagement in learning in US high schools and the apathy of local political systems regarding the quality of local schools is to an important degree a consequence of the failure of employers to reward students for real learning achievements. The solution would appear to be for employers (particularly those with attractive jobs) to use measures of academic achievement such as grades, Regents exams and broad spectrum achievement test batteries (eg. the ASVAB) as a selection criterion when hiring recent high school graduates. Such a policy will also increase the validity of employee selection protocols and thus increase the efficiency by which workers are matched with jobs.

II. THE ROLE OF OCCUPATIONAL COMPETENCY MEASUREMENT IN DEPARTMENT OF LABOR TRAINING PROGRAMS

The Job Corps and the Job Training Partnership Act training programs are increasing their use of validated assessments of occupational competency to evaluate the effectiveness of their training programs, to improve curricula and to signal trainee competencies to potential employers (National Occupational Competency Testing Institute 1989, 1990, 1991).

2.1 HOW VALID ARE OCCUPATIONAL COMPETENCY TESTS?

Meta-analyses of the hundreds of studies of the validity of occupational competency tests have found that content valid occupational competency tests are highly valid predictors of job performance. Dunnette's (1972) meta-analysis of 262 studies of occupational competency tests found that their average correlation with supervisory ratings was .51. This correlation was higher than the correlation of any other predictor studied including cognitive ability tests (.45), psychomotor tests (.35), interviews (.16) and biographical inventories (.34). Vineberg and Joyner's (1982) meta-analysis of military studies found that grades in training school (which were based on paper and pencil tests of occupational competency) had a higher correlation (.27) with global performance ratings by immediate supervisors than any other predictor. The correlations for the other predictors were .21 for ASVAB ability composites, .14 for years of schooling, .20 for biographical inventory and .13 for interest. Hunter's (1982) meta-analysis found that content valid job knowledge tests had a correlation of .48 with supervisory ratings and an even higher correlation of .78 with work sample measures of job performance. Consequently, for training program graduates who are employed in the occupation for which their competency was assessed, scores on these competency exams are highly valid predictors of job performance and promotion probabilities.

It has also been established that occupational skills training programs have substantial effects on occupational competency test results. The findings of two studies comparing students at various stages of their training are reported in Table 1. The first column of the table reports the differences between trained and untrained students on the occupational competency tests developed by American Institutes of Research under a contract with the Office of Vocational and Adult Education. The second column reports the difference between Ohio high school juniors and seniors on most of the competency tests available from the Ohio Vocational Education Achievement Test Program. Since the tests are normally given in the spring, this column is an estimate of the gain in competency that occurs between the end of the first and the end of the second year of a high

Table 1
Effects of Vocational Education on Occupational Competency

Occupation	AIR Trained Versus Untrained	Ohio Seniors Versus Juniors
Word Processing Specialist	88%	43%
Computer Operator	137%	--
General Office Clerk	--	--
Clerk Typist	--	34%
Grocery Clerk/Food Marketing	21%	27%
Apparel Sales	22%	86%
Dental/Medical Assisting	166%	63%
Restaurant/Food Service	26%	25%
Electronics Technician	111%	--
Water Treatment Technician (avg)	132%	--
Diesel Mechanic	132%	47%
Carpentry	76%	60%
Construction Electricity	--	63%
Drafting	--	51%
Machine Trades	--	47%
Welding	--	67%
Cosmetology	--	63%

Source: Table reports estimates of mean competency test score differences between students at different stages of an occupational training program divided by the standard deviation of program completers and multiplied by 100 to turn it into percent. Column 1 is from American Institutes of Research's (1982) report on the Vocational Competency Measures it developed under a contract with the Office of Vocational and Adult Education. Samples ranged from 100 to 296 for the trained students and from 24 to 51 for the untrained students. These tests are now available from AAVIM in Athens Ga. Column 2 gives the mean differences between Ohio high school seniors tested in the spring of the year and juniors also tested in the spring of the year (Instructional Materials Laboratory, 1988).

school vocational program. Mean differences have been put into a common metric by dividing them by the sample standard deviation of the program completers who took the test. While some of the mean differences are less than a third of a standard deviation, most are over half of a standard deviation and some are substantially greater than one standard deviation. The difference between sophomores and juniors and between juniors and seniors on academic achievement tests are generally between 20 and 30 percent of a standard deviation in the final years of high school. Thus, when test standard deviations are the metric of comparison, vocational education appears to produce larger gains (on a narrower front to be sure) than the academic side of high school.

Selective attrition and maturation effects are probably contributing to the differences in competency between trained and untrained individuals (and also between sophomores and seniors on academic achievement tests). Consequently, the true value added of vocational programs is probably somewhat less than the numbers reported.

When occupational competency tests appropriate for the job compete with academic ability tests in predicting job performance measured either by supervisory ratings or actual work samples, the occupational competency tests have about twice as large an effect as ability tests in studies conducted on civilian workers. In studies conducted in the military, occupational competency exams are three or four times as important as the ASVAB battery (Hunter, 1983). This has two important implications for DOL/ETA training policies.

(1)   Gains on occupational competency exams are good immediate indicators of the success of an occupationally specific training program.

(2)   Since large improvements in job knowledge are easier to achieve than equivalent (in proportions of a standard deviation) improvements in verbal and mathematical skills, occupationally specific training will generally be more desireable than generalized basic skills education if the student is almost certain to put the knowledge to use by working in the occupation. Unfortunately, a high proportion of the individuals who receive JTPA occupational training in a classroom do not obtain employment in the field for which they prepared so the occupational component of the training quite often goes to waste. How likely a trainee is to get a job in the field for which they are being trained is, therefore, an important factor in deciding what emphasis to place on occupational versus basic skills in a training program.

2.2 CURRENTLY AVAILABLE OCCUPATIONAL COMPETENCY EXAMS

Occupational competency tests that might be appropriate for DOL training programs are now

available from a variety of sources: the National Occupational Competency Testing Institute (NOCTI), the Instructional Materials Laboratory at Ohio State University, the Vocational Technical Consortium of States (V-TECS), and the American Association for Vocational Instructional Materials (AAVIM) in Athens, Georgia, and the United States Employment Service. The Employment Service has recently completed development of a high quality automated typing test. Oklahoma is currently validating a set of competency tests keyed to the objectives of its competency based curriculum guides.[1] A resource guide developed by the National Center for Research in Vocational Education (1988) is available from AAVIM.

The great numbers of vendors supplying competency tests means that a federal mandate that JTPA programs test the competency of their trainees would not prejudge the issue of what should be taught. Fifty-seven different tests are available from NOCTI--some very narrow in focus and others quite broad (eg. General Office). V-TECS has developed a test item bank which vocational training institutions can access to develop tests which are tailored to the needs of the local community.

Two of the competency testing programs--NOCTI and Oklahoma-- offer inexpensive hands-on-performance tests as one element of their competency testing system. The fact that hands-on tests are available is particularly important because exclusive reliance on paper-and-pencil tests for program evaluation and competency certification would be undesirable. Since occupational competency is more than just knowledge of facts, paper and pencil tests are not, by themselves, a satisfactory assessment of occupational competence. Competence is the ability to apply knowledge to particular real life situations, diagnose practical real world problems and get the job done, and hands-on performance tests are essential if it is to be fairly evaluated.

Many occupational training programs give their graduates a competency profile which describes and certifies the individual student's skills. The Training Achievement Records (TARS) appear to fill this function in the Job Corps. Many students use these profiles as credentials when they seek work in the field. One of the benefits of increasing the number of training programs that use competency testing for accountability purposes is that it is likely to stimulate an increase in the use of competency tests to certify students' achievements. Students in occupational training programs would then have the option of including in their job resumes ratings on the occupational competency tests. This would both motivate them to work hard at developing their occupational competency and at the same time enhance their ability to compete for better jobs.

2.3 THE USE OF OCCUPATIONAL COMPETENCY TESTS TO HELP MARKET GRADUATES OF OCCUPATIONAL TRAINING PROGRAMS

In 1987 the state of Pennsylvania started awarding a **Pennsylvania Skills Certificate** to high school vocational students who demonstrate mastery of their craft by passing the written and hands-on components of the NOCTI Competency Exams. A description of the program is provided in Exhibit 1. In most cases, the local Craft Advisory Committee was recruited to serve as judges for the hands-on performance test. This certificate program has already stimulated changes in the curriculum. In the first year of testing, students did not do very well on the competency tests for clerical occupations. When causes of the deficiency were examined, it was discovered that the problem was not with the test but the curriculum which had become poorly aligned with current employer needs. The result has been a revision of the office education curriculum (J. Cullen, 1988).

The Pennsylvania's Skills Certificate program is just one of many examples of the use of competency certification to help graduates of occupational training programs find jobs. The Department of Labor should strongly encourage the occupational training programs it finances to adopt this strategy. The Occupational Competencies Demonstration Project has shown that the NOCTI tests are remarkably well aligned with the Job Corps occupational curriculums and that the performance components of the test can be administered at Job Corps centers with only slight modifications required. Considering that most of the entrants into the Job Corps have very poor basic skills, their performance at time of exit was truly remarkable. On the written portion of the exam they generally performed less well than the average graduate of a high school vocational program. On the hands-on performance component, however, they were generally above the average for graduates of high school programs (NOCTI, 1991) NOCTI exams are currently being considered for more general use by the Job Corps. I strongly recommend that DOL pursue this option aggressively and mandate that all Job Corps centers use the NOCTI tests as one of their exit assessment tools.

2.4 MEASURING PROGRAM PERFORMANCE FAIRLY AND INEXPENSIVELY

The major barrier to implementing performance measurement in occupational training programs has been the unreliability and inappropriateness of the performance measures currently available. Training-related placement rates are not comparable across vocational-technical programs, are subject to manipulation, and suffer from serious nonresponse problems. Tests of generic and specific occupational competency avoid these problems: they are comparable across

COMMONWEALTH OF PENNSYLVANIA
OFFICE OF THE GOVERNOR
HARRISBURG

Of Pennsylvania's many natural resources, our students are the most important. They are tomorrow's work force, the foundation of our economic future. It is essential, therefore, that all students reach their full potential in basic knowledge and job-related skills.

The Pennsylvania Skills Certificate recognizes high achievement by vocational students. It offers students a chance to demonstrate their abilities through a fair and carefully-prepared examination.

I urge all vocational students to prepare for and to take the tests for the Pennsylvania Skills Certificate. Not only can it reward your own achievement, but it shows everyone the importance of vocational-technical education. The Pennsylvania Skills Certificate tells employers, parents, and co-workers that you are qualified and able to perform today's jobs as well as tomorrow's.

Robert P. Casey

Governor

WHAT OCCUPATIONAL COMPETENCY TESTS WILL BE AVAILABLE?

Accounting/Bookkeeping
Agriculture Mechanics
Appliance Repair
Architectural Design
Audio-Visual Communications
Auto Body
Auto Diesel Mechanics
Automotive Specialist
Baking
Building Construction Occupations
Building Trades Maintenance
Business Data Processing
Cabinetmaking
Carpentry
Child Care Services
Civil Technology
Clothing & Textiles
 Management and Production
Commercial Art
Communications Electronics
Computer & Information Sciences
Construction Masonry
Dental Assisting
Diesel Engine Mechanics
Diversified Occupations
Electrical Construction
 and Maintenance
Electrical Occupations
Electrical Technology
Electromechanical Technology

Electronic Technology
Food Production,
 Management and Service
Forestry Products & Processing
General Drafting & Design
General Office
General Secretarial
Graphic Arts
Health Assisting
Heating
Heating & Air Conditioning
Heavy Equipment
 Maintenance & Repair
Home Health Aide
Horticulture
Industrial Electricity
Machine Trades
Marketing & Distribution
Mechanical Drafting
Medical Assisting
Metalworking & Fabrication
Nursing Assisting
Painting & Decorating
Plumbing
Production Agriculture
Sheet Metal
Small Engine Repair
Upholstering
Warehousing Services
Welding

Pennsylvania

Skills

Certificate

PSC

Commonwealth of Pennsylvania
Robert P. Casey, Governor

Department of Education
Thomas K. Gilhool, Secretary

Exhibit 3.

What is the Pennsylvania Skills Certificate ?

WHAT IS THE PENNSYLVANIA SKILLS CERTIFICATE?

The Pennsylvania Skills Certificate is a special award created by the Pennsylvania Department of Education to recognize high achievement by Vocational Education students.

To receive the certificate, you must be enrolled in an approved program at your school. Also, you must show that you have mastered the knowledge and skills required for an occupation.

HOW WILL YOU BENEFIT?

Having the Pennsylvania Skills Certificate can help you get a good job in your chosen field.

The Pennsylvania Skills Certificate tells employers that you can do the job.

WHY IS IT NEEDED?

Jobs in Pennsylvania are becoming more technical and competitive. That makes it extremely important for you to study hard and make the most of your talents as you prepare to enter the work force.

It is just as important for you to prove your strengths. That way you can find the best job, for you, in the field of your choice.

HOW WILL IT BE EARNED?

You will be able to take the tests for the Pennsylvania Skills Certificate in the Spring of your senior year. To earn the Skills Certificate, you must pass both a written test and a test of how well you can perform job skills. You must demonstrate entry-level job competencies and graduate from an approved program in vocational training.

WHAT TYPE OF TEST WILL BE USED?

You will take a written test and a test of your work skills.

The written test covers factual knowledge, technical information, your understanding of principles, and your ability to solve problems related to your vocational training.

The performance test will consist of work assignments designed to judge your knowledge of skills required to do the job. You will be in the laboratory, shop, or clinical setting you use during your training. In some cases your performance will be judged by the local Craft Advisory Committee.

HOW WILL THE TESTS BE ADMINISTERED AND SCORED?

You will take the tests in your school. The school will obtain tests directly from the National Occupational Competency Testing Institute (NOCTI).

NOCTI will score the tests and provide the results and rankings. Statewide rankings will be reported to the Department of Education. Your individual score will determine your eligibility for the Pennsylvania Skills Certificate. You will receive the Skills Certificate from the Pennsylvania Department of Education.
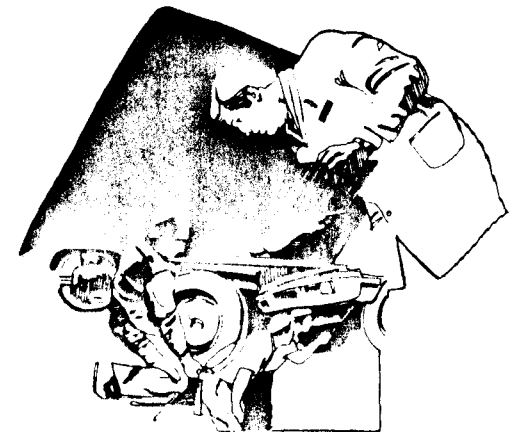
districts, manipulation can be prevented by developing alternate versions of the test and nonresponse can be easily minimized by making the test a part of the student's final grade in the course. Labor market outcome measures are influenced by environmental factors such as the state of the local economy which educators have no control over; competency test scores are not. The tests are cheap to administer. NOCTI charges only $8.95-$9.50 to supply and score its paper-and pencil exam and the costs of consumable materials for the hands-on performance test are only about $6.00 on average.

There is always a danger that accountability systems based on outcomes will exacerbate existing incentives to cream the eligible population.[2] This can be overcome by devising indicators of program performance which take into account the educational background of the trainees in a program when they entered it and by offering additional recognition (or larger reimbursements) for success with more challenging trainees -- the handicapped, and those without work experience or with low scores on basic skills tests. One approach that could be considered is to base the fee paid to training providers by JTPA on the number of completers not the number of students and on the difference between competency test scores of graduates and a prediction of those test scores based on educational background variables and previous work experience. Under such a system, JTPA and training provider staff would face incentives to recruit/admit into JTPA programs every individual they feel they can help.

Performance indicators measuring the value added of individual training programs would not be all that difficult to devise and implement. When the training provider submitted its examination results to JTPA for grading, it could also be asked to provide the data on the educational background of each trainee. The information requested might include subjects studied in high school, parent's education and occupation, and basic skills test scores. State or national JTPA staff could conduct a simple regression analysis of this data and generate a predicted competency test score for each trainee taking the test. The mean difference between the actual and predicted competency test scores would be the basis for assessing the effectiveness of individual training programs. The absolute levels of achievement of program completers would be reported, of course, but attention would be directed at the value added measures. State or national JTPA staff could prepare these statistics and brief local JTPA advisory committees. These briefings would also provide information on other performance indicators such as completion rates, earnings gains based on UI wage record data and training related placement rates and offer comparative data on the performance of similar districts in the state. The advisory committees would be encouraged to use the statistics to identify

individual programs that require improvement.

One of the major benefits of using occupational competency testing to evaluate programs is the diagnostic information that analysis of the test results for individual performance objectives gives teachers and curriculum developers. The experience of Pennsylvania is an example of what might happen on a wider scale if competency testing were to become more widely used. When accountability systems based on training related placement rates and/or earnings gains (estimated from UI wage record data) signal that an individual program is performing poorly, they do not offer program operators a diagnosis of what is wrong. If placement rates are low, the natural tendency is to redouble placement efforts. While an emphasis on placement into high wage jobs is appropriate in JTPA and Job Corps programs, there is a danger of overdoing this emphasis. JTPA is sometimes accused of placing too much emphasis on short term placement rates and insufficient emphasis on the quality of the training. If labor market outcomes are the only performance indicators, the placement director may be the only one made "accountable" by the system. The labor market is not so efficient that we can count on programs that do an excellent job of teaching occupational skills being able to market their graduates at high wages and vice versa. It is important, therefore, that occupational competency tests be a component of accountability system for both JTPA and Job Corps.

2.5 ENCOURAGEMENT OF COMPETENCY BASED INSTRUCTION

One benefit of improving the availability and quality of occupational competency assessment would be the stimulation it would provide to the growth of competency-based vocational education (CBVE). In the last two decades many states have undertaken a comprehensive revision of occupational curricula based on the CBVE approach. This involves describing the goals for each occupational training program in terms of competencies and then developing curriculums and criterion-referenced tests appropriate to the task of teaching these competencies. Competency-based vocational education goes by a number of names: performance-based, outcome-based and competency-based. Grant (1979, p.6) has probably provided the most succinct definition of CBVE:

> Competence-based education tends to be a form of education that derives a
> curriculum from an analysis of a prospective or actual role in modern society and
> that attempts to certify student progress on the basis of demonstrated performance
> in some or all aspects of that role. Theoretically, such demonstrations of
> competence are independent of time served in formal education settings.

Chalupsky et al. describe it as stressing "in depth analysis and continuing adjustment to employment

needs, coupled with the collection of student task performance data as an aid in bringing student performance up to standard and for improving learning materials and instructor effectiveness."[5] After surveying CBVE programs, Russell (1978 pp. 55-56) characterized the exemplary programs as achieving or striving to achieve the following:

- ° Pre-testing students upon entry to determine the skills they already have as well as objectives that need to be achieved

- ° Allowing each student to proceed to subsequent instruction as soon as performance objectives are attained

- ° Providing an alternative method of instruction if a student does not achieve a learning task

- ° Recording students performance as each objective is achieved

- ° Placing greater emphasis on exit requirements (proficiency) than on entrance requirements

- ° Assessing students on the basis of competencies, i.e., criterion-referenced testing is used

The objective is to offer students a "success-oriented atmosphere for learning, where success is measured by job-derived standards as opposed to competitive performance among students"(Hirst, 1977, p. 35).

Competency testing is critical to successful implementation of CBVE. It is needed for screening new students for placement, giving credit for previous learning, advancing students when objectives are achieved, identifying remediation needs, certifying areas of competence at graduation and evaluating the effectiveness of instructional programs (Chalupsky 1982). Accountability is, thus, only one of the many objectives of occupational competency testing. Developing these tests and administering them to thousands of students is costly, so it will generally be desireable for the tests to serve multiple objectives (eg. certification, articulation with more advanced training programs and program evaluation).

Accountability is easier to implement in the context of CBVE, particularly at the classroom instruction level. "Vocational teachers who conduct competency-based programs...are in a good position to appraise their instruction by focusing on its products..." (Erickson, 1979, p. 257). However, a competency-based approach to teaching is not essential to the use of competency testing as a program evaluation tool. Accountability driven competency testing can be implemented in occupational training programs which have not adopted any of the elements of the CBVE approach to instruction. Consequently, a federal requirement that JTPA training providers test the competency of their trainees and for SDAs to use the results in their accountability systems would encourage but not force the adoption of the CBVE approach to instruction.

III. RESEARCH ON THE PREDICTION OF JOB PERFORMANCE: IMPLICATIONS FOR EMPLOYMENT SERVICE REFERRAL POLICIES

3.1 FINDINGS FROM MILITARY RESEARCH

The ARMED SERVICES VOCATIONAL APTITUDE BATTERY (ASVAB) is one of the most thoroughly researched selection and classification batteries in existence, so there is a wealth of evidence on how its subtests effect job performance in a great variety of jobs. The test battery was developed by the US armed forces for use within the military, so military recruits have been the subject of almost all of this research. Eighty percent of the jobs held by enlisted personnel in the military have civilian counterparts, so the research on the validity of the ASVAB in military settings generalizes quite well to large portions of the civilian sector (US Department of Defense, 1984). The civilian occupations that are not represented in the ASVAB research are professional, manager, farmer, sales representative, and sales clerk.

Most of the validity research is prospective in design. It has involved correlating scores on ASVAB tests taken prior to induction with final grades in MOS specific training courses (generally measured at least 4 months after induction). Since recruits are selected into the army and into the various specialties by a nonrandom process, mechanisms have been developed to correct for selection effects--what I/O psychologists call restriction of range (Thorndike 1949; Lord and Novick 1968; Dunbar and Linn 1986). These selection models assume that selection into a particular MOS is based on ASVAB subtest scores (and in some cases measures of the recruit's occupational interests). For the military environment, this appears to be a reasonable specification of the selection process for attrition is low and selection is indeed explicitly on observable test scores. This ability to model the selection process is an advantage that validity research in the military has over research in the civilian sector.[4] The use of prospective rather than concurrent research designs is another strength of the studies of job performance conducted in the military.

Since training course grades are often based on paper and pencil tests, there is a danger that validity coefficients may be biased by common methods bias. It would be desireable to check these findings in a data set in which ASVAB subtest scores predict a hands-on measure of job performance. Maier and Grafton's (1981) study of ASVAB 6/7's ability to predict the hands-on Skill Qualification Test (SQTs) provides such a data set. Maier and Grafton described the hands-on SQTs they used in their study as follows:

> SQTs are designed to assess performance of critical job tasks. They are criterion referenced in the sense that test content is based explicitly on job requirements and

the meaning of the test scores is established by expert judgment prior to administration of the test rather than on the basis of score distributions obtained from administration. The content of SQTs is a carefully selected sample from the domain of critical tasks in a specialty. Tasks are selected because they are especially critical, such as a particular weapon system, or because there is a known training deficiency. The focus on training deficiencies means that relatively few on the job can perform the tasks, and the pass rate for these tasks therefore is expected to be low. Since only critical tasks in a specialty are included in SQTs, and then only the more difficult tasks tend to be selected for testing, a reasonable inference is that performance on the SQTs should be a useful indicator of proficiency on the entire domain of critical tasks in the specialty; that is, workers who are proficient on tasks included in an SQT are also proficient on other tasks in the specialty. The list of tasks in the SQT and the measure themselves are carefully reviewed by job experts and tried out on samples of representative job incumbents prior to operational administration (pp. 4-5).

A more extensive discussion of the procedures for developing SQTs is available in a handbook (Osborn et al, 1977). A thorough discussion of their rationale is provided in Maier and Hirshfeld (1978).

Regressions were estimated using LISREL for nine major categories of Military Occupational Specialties (MOS): Skilled Technical, Skilled Electronic, General Maintenance, Mechanical Maintenance, Clerical, Missile Battery and Food Service Operators, Unskilled Electronic, Combat and Field Artillery. Except for combat and field artillery, these MOSs have close counterparts in the civilian sector. The independent variables were the 10 ASVAB 6/7 subtest scores. Examples of the kinds of items used in these subtests are given in Appendix A. The standardized regression coefficients from this analysis are reported in Table 2. These coefficients are an estimate of the effect of a one population standard deviation improvement in a test score on the hands-on job performance criterion measured in standard deviation units. Since the ASVAB subtests measure competencies with error and this error has not been corrected for, these results provide lower bound estimates of the effects of the true competencies on true job performance.

The four "technical" subtests--mechanical comprehension, auto information, shop information and electronics information--had no effect on job performance in clerical jobs, but **very substantial** *effects on job performance in all the other occupations.* The impact of a one population standard deviation increase in all four of these subtests was an increase in the SQT of .415 SD in skilled technical jobs, of .475 SD in skilled electronics jobs, of .316 SD in general maintenance jobs, of .473 SD in mechanical maintenance jobs, of .450 SD for missile battery operators and food service workers and of .170 SD in unskilled electronics jobs. The proportionate change in productivity that results was somewhere between 25 and 40 percent of these numbers.[3] If we assume the SD of true

Table 2. Effect of competencies on job performance (SQT).

	Mechanical Comprehension	Auto. Info.	Shop Info.	Electr. Info.	Attention to Detail	Comp. Speed	Word Knowl.	Arith. Reasoning	Math Knowl.	Science	R^2
Skilled technical	0·092***	0·017	0·132***	0·174***	0·024	0·031	0·215***	0·062**	0·121***	0·057*	0·548
(1324)	(3·07)	(0·58)	(4·28)	(5·09)	(1·12)	(1·17)	(6·77)	(1·96)	(3·76)	(1·83)	
Skilled electronic	0·086	0·098	0·246***	0·045	0·084	−0·013	−0·004	−0·021	0·261***	0·072	0·426
(349)	(1·30)	(1·49)	(3·64)	(0·60)	(1·81)	(0·22)	(0·06)	(0·30)	(3·67)	(1·05)	
General (const.) maintenance	−0·004	0·082**	0·117***	0·121***	0·043*	0·068***	0·066*	−0·101***	0·441***	0·134***	0·592
(879)	(0·11)	(2·34)	(3·25)	(3·05)	(1·76)	(2·19)	(1·80)	(2·73)	(11·70)	(3·67)	
Mechanical maintenance	0·042	0·314***	0·206*	−0·089	0·055	0·235**	−0·004	−0·068	0·061	0·096	0·412
(131)	(0·38)	(2·88)	(1·84)	(0·71)	(0·72)	(2·43)	(0·03)	(0·59)	(0·52)	(0·85)	
Clerical	−0·068	0·087***	−0·030	0·065	0·015	0·085**	0·118***	0·241***	0·206***	0·064	0·425
(830)	(−1·59)	(2·05)	(−0·69)	(1·33)	(0·50)	(2·24)	(2·61)	(5·33)	(4·46)	(1·44)	
Operators and food	0·109*	0·179***	0·062	0·100**	0·050	−0·037	0·061	0·114*	0·106**	0·076*	0·414
(814)	(2·50)	(4·11)	(1·39)	(2·02)	(1·62)	(0·96)	(1·33)	(2·47)	(2·25)	(1·66)	
Unskilled electronic	0·004	0·027	0·062*	0·077**	0·036	0·053*	−0·010	0·058*	0·018	−0·025	0·052
(2545)	(0·14)	(0·87)	(1·93)	(2·15)	(1·65)	(1·92)	(0·31)	(1·75)	(0·55)	(0·76)	
Combat	0·147***	0·060***	0·080***	0·058***	0·048***	0·035**	0·069***	0·070***	0·139***	0·070***	0·358
(5403)	(8·28)	(3·38)	(4·42)	(2·86)	(3·82)	(2·23)	(3·71)	(3·74)	(7·29)	(3·82)	
Field artillery	0·059	0·047	0·030	0·134**	0·088**	−0·009	0·000	0·186***	0·230***	0·061	0·422
(534)	(1·10)	(0·89)	(0·56)	(2·21)	(2·33)	(0·19)	(0·01)	(3·28)	(3·99)	(1·10)	

Source: Reanalysis of Maier and Grafton's (1981) data on the ability of ASVAB 6/7 to predict Skill Qualification Test (SQT) scores. The correlation matrix was corrected for restriction of range by Maier and Grafton.

productivity averages 30 percent of the mean wage in these jobs, the impact of a simultaneous one SD increase in all four technical subtests is about 11.5 percent of the wage (or about $2875 per year) averaging across the six non-clerical non-combat occupations. **The GATB does not currently contain a subtest assessing mechanical comprehension or technical knowledge and skills. Clearly, the ability of the GATB to predict job performance would be substantially enhanced by adding subtests similar to those found in the ASVAB which assess mechanical comprehension, electronics knowledge and technical competence.**

The attention to detail subtest (which is similar to the clerical checking subtest in ASVAB 8A) had no effect on performance in clerical jobs and small effects on performance in skilled electronic, general maintenance, combat arms and field artillery.

The two mathematical reasoning subtests had substantial effects on SQTs. *The Math Knowledge subtest assessing algebra and geometry was responsible for most of this effect.* A one standard deviation increase in competence in algebra and geometry raised predicted job performance by .121 SD in skilled technical jobs, .261 SD in skilled electronic jobs, .44 SD in general maintenance jobs, .206 SD in clerical jobs, .106 SD for missile battery operators and food service jobs, .139 in combat arms and .230 in artillery. **The GATB does not currently contain a subtest covering knowledge of algebra and geometry. Clearly, the ability of the GATB to predict job performance would be substantially enhanced by adding a subtest assessing competence in algebra and geometry.**

The arithmetic reasoning test was significant in 7 of the MOS clusters and had large positive effects on performance in clerical (.24 SD), missile battery and food service (.11 SD), and field artillery (.186 SD) jobs. Assuming that the standard deviation of true productivity is 30 percent of the wage, the impact of a simultaneous one SD increase in both mathematics reasoning subtests is 6.4 percent averaging across all seven non-combat occupations.

Science knowledge had positive effects on hands-on measures of job performance in eight of the MOS clusters, significantly so in 4 clusters and in pooled data. A one standard deviation (SD) increase in science knowledge raised job performance by .057 SD in skilled technical jobs, .072 SD in skilled electronics jobs, .134 SD in general maintenance and construction jobs, .096 SD in mechanical maintenance jobs, .064 SD in clerical jobs, .076 SD in missile battery operator and food service jobs and .070 in combat arms. Word knowledge had significant effects on job performance in the skilled technical, general maintenance and clerical jobs and in combat arms. While statistically significant, the effects of these two competencies appear to be rather modest. Assuming that the standard deviation of true productivity is 30 percent of the wage, the effect of

a one SD increase in test scores is 2 percent of the wage for science and 1.9 percent for word knowledge averaged across the seven noncombat occupations.

Differences in mathematics, science or verbal competency of one population SD are quite large. In these subjects, one population SD is about the magnitude of the difference between young people with 14 years of schooling and those who left school after the 9th grade. Consequently, a productivity increase of about 2 percent per population SD on the test may appear to be only a modest return. This may be due to the inadequacies of the 11 minute long ASVAB subtests used to assess these competencies. General Science had only 24 items and Word knowledge only 35. This biases down the estimated effects of science and word knowledge on job performance. **Clearly, there is a need for new research to determine whether broader and more reliable measures of verbal capacity, scientific knowledge and understanding, and problem solving ability have more substantial effects on job performance in non-technical jobs than these ASVAB subtests.**

Analysis of Project A Data on Core Technical Proficiency

Still more evidence on what truly determines job performance comes from Project A, a massive study (total costs of more than $100,000,000) that is developing improved methods for selecting and classifying army personnel. Wise, McHenry, Rossmeissl and Oppler (1987) have estimated ASVAB validities for 19 very diverse jobs using Core Technical Proficiency, a MOS specific job performance measure, as the criterion. These ratings are about 50 percent based on hands-on work sample tests (the hands-on SQT) and 50 percent based on paper and pencil job knowledge exams. The ratings were obtained after the recruit had been in the army for 2 to 3 years. The study was designed to select the three or four ASVAB subtests which could be used as the aptitude composite for that MOS cluster.

Table 3 reports the names of the three or four subtests which in combination did the best job of predicting Core Technical Proficiency. As before, the technical subtests were important predictors of Core Technical Proficiency in all the nonclerical occupations. For the academic subtests the results were similar to the results of the reanalysis of Maier and Grafton's validity data for hands-on work samples. Computational speed was only a weak determinant of job performance. Competence in science, language arts and mathematical reasoning had very large effects on job performance.

The results of military research on job performance clearly implies that different occupations tap different abilities. Mechanical comprehension tests are very strongly associated with job

Table 3
ASVAB SUBTESTS WHICH ARE THE BEST PREDICTORS OF CORE TECHNICAL PROFICIENCY
by Military Occupational Specialty Cluster

Subtest	Technical	Speed	Quantitative	Verbal/Science
Electronics Repair (123)	Electronics	Compute-Speed		Science
Skilled Tech. (1329)	Mechanical Comp.		Math Knowledge	Science Verbal
Mechanical Maintenance (716)	Auto-Shop Know. Mechanical Comp. Electronics			Science
General Maintenance (272)	Auto-Shop Know.		Math Knowledge	Science Verbal
Operators/Food (1215)	Auto-Shop Know.		Arith Reasoning Math Knowledge	Verbal
Surveillance & Communication (289)	Auto-Shop Know.	Compute-Speed	Math Knowledge or Arith Reason.	Verbal
Clerical (1210)			Arith Reasoning Math Knowledge	Verbal
Combat (1429)	Auto-Shop Know. Mechanical Comp.		Math Knowledge	Science
Field Artillery (464)	Auto-Shop Know. Mechanical Comp.	Compute-Speed		Science

Source: Summarized from Table 2 of Wise, McHenry, Rossmeissl and Oppler, 1987. Based on an analysis of the ability of ASVAB subtests to predict Core Technical Proficiency ratings after the recruit has been in the US Army for 2 or 3 years. Core Technical Proficiency ratings are about 50 percent based on hands-on work sample tests and 50 percent based on paper and pencil job knowledge exams. The subtests listed in the table are the 3 or 4 subtests which in combination maximized the R^2 of the model predicting Core Technical Proficiency.

performance in craft and other the blue collar jobs but not in clerical jobs. Mathematical skills are more important in some occupations than others. Verbal skills similarly vary in their importance. **These findings reinforce our earlier conclusion that subtests assessing mechanical comprehension, technical knowledge, algebra and geometry should be added to the GATB and that different prediction models will be required for white collar and blue collar jobs of the same complexity.**

3.2 GHISELLI'S REVIEW OF CIVILIAN RESEARCH PRIOR TO 1973

Over the last 50 years, industrial psychologists have conducted hundreds of studies, involving many hundreds of thousands of workers, on the relationship between supervisory assessments of job performance and various predictors of performance. In 1973 Edwin Ghiselli published a compilation of the results of this research organized by type of test and occupation. Table 4 presents a summary of the raw validity coefficients (correlation coefficients uncorrected for measurement error and restriction of range) for six types of tests: mechanical comprehension tests, "intelligence" tests, arithmetic tests, spatial relations tests, perceptual accuracy tests and psychomotor ability tests. Mechanical comprehension tests assess material that is covered in physics courses and applied technology courses such as auto mechanics and carpentry. The intelligence tests used in this research were paper and pencil tests assessing verbal and mathematical competency.

Intelligence tests were the best predictors of the performance of foreman. For craft occupations and semi-skilled industrial jobs, the mechanical comprehension tests are more valid predictors of job performance than any other test category. For protective occupations, mechanical comprehension tests and intelligence tests had equal validity. For clerical jobs, the best predictors of job performance were tests of intelligence, arithmetic and perceptual accuracy (1990).

The summary table gives a clear impression that different occupations tap different abilities. Mechanical comprehension tests are strongly associated with job performance in the blue collar jobs but not in clerical jobs. Mathematical skills are more important in some occupations than others. Verbal skills similarly vary in their importance.

It would appear that measures of mathematical, verbal and generic technical competence had substantial effects on job performance in the studies conducted before 1973. The National Academy of Science report has suggested that the ability of the GATB battery to predict job performance appears to be lower in the studies conducted since 1972. How strong a predictor is the GATB now? It is to this question we now must turn.

Table 4
Raw Validity Coefficients

	Mechanical Comprehension	Intelligence	Arithmetic	Spatial Relations	Perceptual Accuracy	Psychomotor Abilities
Foreman	23[c]	28[c]	20[d]	21[d]	27[d]	15[b]
Craftworkers	26[d]	25[f]	25[f]	23[f]	24[e]	19[f]
Industrial Workers	24[d]	20[f]	21[f]	21[f]	20[f]	22[f]
Vehicle Operators	22[d]	15[d]	25[c]	16[c]	17[b]	25[d]
Service Occupations	----	26[d]	28[d]	13[d]	10[d]	15[d]
Protective Occupations	23[b]	23[d]	18[c]	17[d]	21[c]	14[d]
Clerical	23[d]	30[f]	26[f]	16[c]	29[f]	16[f]

Source: Ghiselli (1973) compilation of published and unpublished validity studies for job performance. The raw validity coefficients have not been corrected for restriction of range or measurement error in the performance rating. The Perceptual Accuracy category include number comparison, name comparison, cancellation and perceptual speed tests. They assess the ability to perceive detail quickly. Psychomotor tests measure the ability to perceive spatial patterns and to manipulate objects quickly and accurately. This category of tests includes tracing, tapping, doting, finger dexterity, hand dexterity and arm dexterity tests.

[a] Less than 100 cases.
[b] 100 to 499 cases.
[c] 500 to 999 cases.
[d] 1,000 to 4,999 cases.
[e] 5,000 to 9,999 cases.
[f] 10,000 or more cases

3.3 ANALYSIS OF GATB VALIDATION STUDIES

More recent data on what predicts job performance in the civilian sector is available from the US Employment Service's program for revalidating the General Aptitude Test Battery (GATB). This data set contains data on job performance, the 9 GATB "aptitudes" and background data on 36,614 individuals in 159 different occupations from studies conducted after 1972. Professional, managerial and high level sales occupations were not studied but the sample is quite representative of the 71,132,000 workers in the rest of the occupational distribution. It ranges from drafters and laboratory testers to hotel clerks and knitting-machine operators.

Since a major purpose of these validation studies was to examine the effects of race and ethnicity on the validity of the GATB, the firms that were selected tended to have an integrated workforce in that occupation. Firms that used aptitude tests similar to the GATB for selecting new hires for the job being studied were excluded. The employment service officials who conducted these studies report that this last requirement did not result in the exclusion of many firms. A total of 3052 employers participated.

The workers in the study were given the GATB test battery and asked to supply information on their age, education, plant experience and total experience. Plant experience was defined as years working in that occupation for the current employer. Total experience was defined as years working in the occupation for all employers. The dependent variable was an average of two ratings (generally two weeks apart) supplied by the worker's immediate supervisor. The Standard Descriptive Rating Scale obtains supervisory ratings of 5 aspects of job performance (quantity, quality, accuracy, job knowledge and job versatility) as well as an "all around" performance rating (see Appendix B). Some studies employed rating scales specifically designed for that occupation and in one case a work sample was one of the job performance measures. None of the studies used ticket earnings from a piece rate pay system as the criterion. Studies which used course grades or tests of job knowledge as a criterion were excluded. Firms with only one employee in the job classification were excluded, as were individuals whose reported work experience was inconsistent with their age.

The mathematical achievement index (N) was an average of normalized scores on an arithmetic reasoning test and on a numerical computations test. Verbal ability was assessed by a vocabulary test. Perceptual Speed was the sum of the P and Q aptitudes of the GATB divided by 36.72 to put it in a population SD metric. Psychomotor Ability was the sum of the K, F and M aptitudes of the GATB divided by 51.54 to put it in a population SD metric. The GATB does not contain tests assessing knowledge of electronics, mechanical comprehension, auto mechanics or shop

knowledge.

Because wage rates, average productivity levels and the standards used to rate employees vary from plant to plant, mean differences in ratings across establishments have no real meaning. Only deviations of rated performance $(R^m_{ij}-R^m_j)$ from the mean for the establishment (R^m_j) were analyzed. The variance of the job performance distribution was also standardized across establishments by dividing $(R^m_{ij}-R^m_j)$ by the standard deviation of rated performance, $(SD_j(R^m_{ij})$, calculated for that firm (or 3 if the sample SD is less than 3).[4] The model that was estimated for each major occupational category was:

(1) $\dfrac{R^m_{ij}-R^m_j}{SD_j(R^m_{ij})} = \beta_o + \beta_1(\underline{T}_{ij}-\underline{T}_j) + \beta_2(S_{ij}-S_j) + \beta_3(\underline{X}_{ij}-\underline{X}_j) + \beta_4(\underline{D}_{ij}-\underline{D}_j) + v_2$

where R_{ij} = ratings standardized to have a zero mean and SD of 1.

$\underline{T}_{ij}$ = a vector of the five GATB aptitude composites

S_{ij} is the schooling of the ith individual.

$\underline{X}_{ij}$ = a vector of age and experience variables--age, age^2, total occupational experience, total occupational experience^2, plant experience and plant experience^2.

$\underline{D}_{ij}$ = a vector of dummy variables for black, Hispanic and female.

$\underline{T}_j$, S_j, $\underline{X}_j$ and $\underline{D}_j$ are the means of test composites, schooling, experience variables and race and gender dummies for the jth job/establishment combination. Normalized ratings deviations were predicted by deviations from the job/establishment's mean for gender, race, Hispanic, age, age squared, plant experience, plant experience squared, total occupational experience, total occupational experience squared, schooling and test composites.

It should be recognized that the validity literature in general and this model in particular do not yield unbiased estimates of the true structural relationships prevailing in the full population (Brown 1978; Mueser and Maloney 1987). Validity studies based on examining which job incumbents are most productive are subject to bias for three reasons: omitted variables, the selection process that determines which new hires were retained by the firm and the selection process by which members of the population were hired for the job.

While equation 1 is a more complete specifications of the background determinants of job performance than is typically found in the validity literature, it lacks controls for important characteristics of the worker which effect worker productivity. Examples of things left out of the model are occupationally specific schooling, grades in relevant subjects in school, reputation of the school, the amount and quality of on-the-job training, performance in previous jobs, character traits

like reliability and need to achieve, physical strength and a desire to work in the occupation. Exclusion of these variables from the model causes the coefficients of included variables to be biased.

The second problem arises from the fact that job performance outcomes have been used to select the sample used in the analyses. Since incompetent workers were fired or induced to quit and high performing workers were probably promoted to jobs of a higher classification, the job incumbents used in this study were a restricted sample of the people originally hired for a job. The systematic nature of attrition from the job substantially reduces the variance of job performance and biases coefficients of estimated job performance models toward zero. When all variables are multivariate normal, the ratio of the coefficients estimated in the selected sample ($\beta*$) to the true coefficient estimated in an unselected population (β) is equal to:

$$(2) \quad \beta*/\beta \;=\; VR/(1-R^2(1-VR)) \;=\; VR + R*^2(1-VR)$$

where VR is the ratio of the variance of y in the selected sample to its variance in the full population, R^2 is the multiple coefficient of determination of y on $\underline{x}$ in the full population and $R*^2$ is the multiple coefficient of determination of y on $\underline{x}$ in the selected population (Goldberger 1981). Estimates of VR, the ratio of incumbent job performance variance to new hire job performance variance can be derived from the NCRVE employer survey analyzed in Bishop (1987a, 1988a). Data on the reported productivity in the 3rd through 13th week after being hired of two different workers was employed to calculate a variance ratio by dividing job performance variance of incumbents (pairs of workers both of whom were still at the firm at the time of the interview a year or so after being hired) by the job performance variance of a group of very recent hires (pairs of workers both of whom stayed at least 13 weeks but who may or may not have remained at the firm through the interview). The resulting estimate of VR was .486.[5] Assuming multi-variate normality and noting that the R^2 of the models in table 8 averages about .16, our estimate of $\beta/\beta*$, the multiplier for transforming the coefficients estimated in the selected sample into estimates of population parameters, is 1.76.

The third source of problems is selection effects introduced by the selection that precedes the hiring decision. If hiring selections were based entirely on X variables included in the model, unstandardized coefficients such as $\beta^\wedge$ would be unbiased and correction formulas would be available for calculating standardized coefficients and validities. Unfortunately, however, incidental selection based on unobservables such as interview performance and recommendations is very probable (Thorndike 1949; Olson and Becker 1983; Mueser and Maloney 1987). In a selected

sample like accepted job applicants, one cannot argue that these omitted unobservable variables are uncorrelated with the included variables that were used to make initial hiring decisions and, therefore, that coefficients on included variables are unbiased. When someone with 10 years of formal schooling is hired for a job that normally requires 12 years of schooling, there is probably a reason for that decision. The employer saw something positive in that job applicant (maybe the applicant received a particularly strong recommendation from previous employers) that led to the decision to make an exception to the rule that new hires should have 12 years of schooling. The analyst is unaware of the positive recommendations, does not include them in the job performance model and, as a result, the coefficient on schooling is biased toward zero. This phenomenon also causes the estimated effects of other worker traits used to select workers for the job such as previous relevant work experience to be biased toward zero. Variables which were not used to select new hires such as the GATB test scores will probably have a positive correlation with the unobservable. Since the unobservable probably has its own independent effect on job performance (ie. it is not serving solely as a proxy for test scores), test score coefficients may be positively biased. Mueser and Maloney (1987) experimented with some plausible assumptions regarding this selection process and concluded that coefficients on education were severely biased but that coefficients on test scores were not substantially changed when these incidental selection effects were taken into account. Consequently, the biases that are inevitably present in validity research conducted in the field are not likely to spuriously exaggerate the true effect of predictor variables. Much can be learned about the determinants of job performance from this line of research.

Effects of Aptitude Tests

The results of estimating equation 1 are presented in Table 5. The GATB aptitudes have substantial effects on supervisory ratings. Selecting workers who have a one population SD advantage on both the mathematical and verbal GATB aptitudes will, holding the other aptitudes constant, increase predicted job performance by .23 to .30 of a standard deviation (SD) in technical, clerical and service jobs, by .15 SD in craft jobs and by .12 in operative jobs. Mathematical achievement was clearly the most important determinant of job performance for all occupational categories except operatives. The effect of mathematical achievement on the performance of operatives was highly significant but of more modest size. Verbal ability had no effect on job performance in craft and operative jobs but highly significant effects on performance as a clerical or service worker.

Spatial ability had significant positive effects on performance only for craft occupations. Perceptual speed had small effects on job performance, but the coefficients are nevertheless

Table 5
Determinants of Job Performance

	Technician	High Skill Clerical	Low Skill Clerical	Craft Workers	Operatives	Service
Mathematics	.198*** (.035)	.161*** (.033)	.207*** (.026)	.168*** .017	.107*** (.018)	.223*** (.039)
Verbal	.051 (.038)	.073** (.035)	.070** (.030)	-.018 (.020)	.012 (.023)	.078* (.046)
Spatial Perception	.025 (.029)	-.068*** (.026)	-.002 (.021)	.075*** (.014)	.022 (.016)	.039 (.034)
Perceptual Ability	.026 (.036)	.106*** (.031)	.103*** (.025)	.048*** (.018)	.082*** (.019)	.063* (.038)
Psychomotor Ability	.113*** (.027)	.094*** (.026)	.091*** (.021)	.083*** (.013)	.145*** (.015)	.133*** (.030)
Yrs. of Schooling	.031* (.016)	.026 (.016)	-.014 (.013)	-.009 (.007)	-.036*** (.008)	-.020 (.017)
Relevant Experience	.041*** (.014)	.019 (.015)	.042*** (.012)	.040*** (.005)	.036*** (.010)	.082*** (.016)
(Relevant Experience)^2	-.00094** (.00046)	-.00012 (.00046)	-.0009** (.0004)	-.00025* (.00015)	-.0005 (.0003)	-.0021*** (.0005)
Tenure^2	.085*** (.015)	.113*** (.016)	-.0925*** (.014)	.0620*** (.0056)	.079*** (.011)	.054*** (.019)
Tenure Sq.	-.0024*** (.0006)	-.0031*** (.0006)	-.0026*** (.0006)	-.00156*** (.00018)	-.0017*** (.0004)	-.00131 (.00077)
Age	-.0024 (.0163)	.040*** (.015)	.037*** (.010)	.052*** (.0078)	.053*** (.007)	.044*** (.013)
(Age-18)^2	-.00012 (.00021)	-.00064*** (.00020)	-.00062*** (.00013)	-.00071*** (.00010)	-.00072*** (.00009)	-.00055*** (.00017)
Female	.057 (.056)	.063 (.072)	-.024 (.063)	-.396*** (.066)	-.194*** (.043)	.166** (.073)
Black	-.138** (.060)	-.390*** (.054)	-.146*** (.042)	-.247*** (.032)	-.216*** (.029)	-.031 (.063)
Hispanic	.046 (.099)	-.286*** (.086)	.053 (.069)	-.109*** (.042)	-.053 (.049)	-.076 (.108)
R. Square	.114	.167	.139	.150	.145	.153
Number of Obs.	2384	2570	4123	10016	8167	1927

Source: Analysis of GATB revalidation data in the US Employment Services Individual Data File. Deviations of job performance ratings from the mean for the job/establishment are modeled as a function of deviations of worker characteristics from the mean for the job/establishment. The test scores are in a population standard deviation metric. The metric for job performance is the within job/establishment standard deviation.

significant in all but technical occupations (where the sample is quite small).

Psychomotor skills were significantly related to performance in all occupations but in the better paid and more complex jobs the magnitude of the effect was only about one-third of that of verbal and mathematical achievement together. The effect of psychomotor skills was larger in the two least skilled occupations--operatives and service except police and fire. For operatives the impact of psychomotor skills was roughly comparable to the impacts of mathematical and verbal achievement. These results are consistent with previous studies of these and other data sets (Hunter 1983). Models were estimated containing squared terms for academic achievement and psychomotor skills but these additions did not produce significant reductions in the residual variance.

The estimated effects of the GATB aptitudes on job performance are different in clerical and blue collar occupations. Verbal abilities are very important in clerical and service jobs but have no effect on job performance in craft and operative jobs. These results imply that workers who are high on perceptual and verbal ability will tend to have a comparative advantage in clerical jobs. Workers who are high in spatial and mathematical ability but low on verbal ability will have a comparative advantage in craft jobs. Analysis in section 3.1 of military studies of job performance supports the conclusion that it is possible to use test batteries like the GATB and the ASVAB to identify which occupations particular workers are likely to be particularly good at.

The employment service's system for referring clients to employers should attempt to maximize the comparative advantage of the client. A system like the current VG-GATB system would be used but it would be modified to maximize the ability to predict a worker's comparative advantage. At an absolute minimum the current three trait summary of the GATB battery--general academic aptitude (referred to as GVN in GATB publications), perceptual ability and psychomotor ability--should be expanded to six traits by decomposing general academic aptitude into verbal achievement, mathematical achievement (based on power tests of arithmetic problem solving ability and competence in algebra and geometry), a new technical competence construct (based on the ASVAB's technical subtests, the NAEP science and technology test or a specially developed test) and spatial ability. Occupational competency tests which include a performance component would also be used as well as a biodata form assessing work experience in the occupation and affective traits.

Job analysis information should be used to define a longer list of job families (probably somewhere between 10 and 20) which are presumed to require a similar mix of abilities. At a minimum, the job families should distinguish between jobs for which technical competence is unimportant such as clerical jobs and jobs for which familiarity with the technical matters

is important. Another important distinction is between jobs where mathematical skills are extremely important and verbal skills are not important and jobs where verbal skills are quite important. Separate prediction models would then be estimated for each occupational category using the richer set of ability constructs and validity would be presumed to generalize within these job families. The resulting system would look much like the job assignment system currently in use by the armed forces--a system that has no doubt contributed to the professionalism that American troops have exhibited in the Persian Gulf. This system is being revised and improved with the help of the Project A study. There is much that can be learned from Project A and other studies of performance in the military and this knowledge should be applied to the task of developing an effective ES referral system.

When test scores are controlled, years of schooling had very small and sometimes negative effects on job performance in all occupations except technical occupations. Mueser and Maloney (1988) argue persuasively, however, that since schooling is a very important factor in the selection process, the coefficients on schooling in estimations like these are negatively biased estimates of true population relationships.

Effects of Work Experience

The effects of occupational experience and tenure are quite substantial for all occupations. The negative coefficients on the square terms for occupational experience and tenure imply they are subject to diminishing returns. The effect of tenure on job performance stops rising and starts to decline somewhere between 16 and 24 years of tenure.

Increases in occupational experience obtained prior to starting employment at the plant have a positive effect on job performance throughout the range of actual data. The positive effect does not drop to zero until 37 years of experience for operatives, 55 years for craft workers and high skill clerical workers and 19-31 years for other occupations. Workers with one year of previous experience in the field rather than no experience are about 12-13 percent of a standard deviation more productive in the first year on the job and about 8-9 percent of an SD in the fifth year on the job. Relative to someone with no relevant work experience, a worker with 5 years of relevant work experience is predicted to be slightly more than 50 percent of an SD more productive in the first year on the job and about 33 percent of an SD more productive in the fifth year on the job. *Because occupational experience was probably used to select new hires for the job, the true effect of previous occupational experience is almost certainly larger than that estimated in this regression. The productivity gain from hiring a worker with 5 years of occupational experience is thus substantially larger than the gain resulting from hiring a worker who is one population standard*

deviation (about 5 grade level equivalents) higher in verbal and mathematical ability.

Except for technicians, age has large curvilinear effects on job performance as well. Holding tenure and occupational experience constant, age had a significant positive effect on job performance in all except technical occupations. In these occupations, twenty year olds with no experience at all in the field were 7.2 to 10.3 percent of an SD more productive than 18 year olds with no experience in the field. Thirty year olds with no occupational experience were 4.7 to 7.4 percent of an SD more productive than 28 year olds with no experience in the field.

The substantial effects of age and previous occupational experience on job performance are consistent with current hiring practices which give important weight to previous work experience. McDaniel, Schmidt and Hunter's (1988) meta analysis supports this conclusion, as well. They found that assessments of the amount and relevance of an individual's previous work experience are a valid predictor of job performance. Ratings of experience using the behavioral consistency method appeared to have the greatest validity. These results suggest that a job applicant who has age and relevant work experience in their favor but low test scores may nevertheless be preferable to a young applicant who has high test scores but no relevant work experience. This is particularly likely to be the case if turnover rates are high for the productivity benefits of age and previous relevant work experience are large initially but diminish with time on the job.

<u>Incorporating Work Experience Assessment into VG-GATB</u>: Consequently, it is very important that ES referrals be based on previous experience in the occupation (or a closely related one) and the total amount of work experience as well as aptitude test scores. The referral system in place prior to VG-GATB was built almost entirely around matching the workers specific skills and experience to the specific needs of employers. In its initial conception, the VG-GATB system was not going to take previous occupational experience into account in the referral process (Hawk et al. 1986). Employers were, however, allowed to specify a minimum level of occupational experience requirement to be used as a screening criterion prior to the implementation of the GATB referral process and almost all employers chose to do so. Some have been highly specific about their work experience requirements asking only for people who have used a particular machine in past jobs or worked in a particular 9 digit DOT occupation in the past. Others have been more general, asking only for X years of experience in clerical jobs or Y years of experience in industrial jobs. Employers are also able to make two step requests: for example, "Please refer typists who know WordPerfect, but if none are available please refer typists with some experience with word processing." Employers should be encouraged to continue to specify skill and

occupational experience requirements.

There are two good reasons, however, why occupational experience assessment should also be a part of the VG-GATB system. First, ignoring specific occupational experience when making referrals reduces classification efficiency and the overall validity of the system. Quite often, the work experience screening criterion selected by the employer will leave a large pool of eligibles who have varying amounts of relevant occupational experience. When it comes to making the referral, the ES clients who have considerable experience in the occupation will not be any more likely to be referred. GATB test scores will determine which applicant gets interviewed and the employer will never have a chance to make a decision to give the worker's previous relevant experience positive weight.

The second reason for formally including work experience in the ranking algorithm for making referrals is to improve the face validity and fairness of the referral system. I think that most of the public will view a referral system based solely on test scores and which ignores measurable differences in relevant occupational experience as unfair to older workers. Older workers perform less well on these aptitude tests but quite often their past experience in the field makes up for the slow downs in reaction time that comes with age. Test taking skills also tend to become rusty with absence from school.

Incorporating previous occupational experience into the referral process is too important a goal to be left to idiosyncratic specifications of employer job orders. Meta analyses have found that measures of relevant occupational experience do have useful levels of validity and that their validity appears to generalize. It is not difficult to take previous work experience into account when making job referrals. A method of incorporating it into a VG-GATB system is described and employed in the next section.

IV. THE SOCIAL BENEFITS OF INCREASED USE OF THE GENERAL APTITUDE TEST BATTERY FOR EMPLOYEE SELECTION

The evidence just reviewed clearly establishes that it will generally be in a company's interest to use employment tests as one of the factors in making decisions about whom to hire. Since, however, the top quality worker who is identified by an employment test and hired by company A is not available to company B or C, the gain to company A may be partially or wholly offset by the loss to other firms. When such offsets are taken into account, how large will the social benefits of greater use of employment tests be? This is a very important issue, for if the social benefits including offsets are very small or the use of basic skill tests for selection does not create incentives to study in school, it would be unwise for a public agency to become involved in promoting the use of employment tests and the ES should stop funding the GATB program.

4.1 How to Calculate the Social Benefits of Greater Use of the GATB

Greater use of employment aptitude tests increases aggregate output when:

* Different occupations require different abilities, tests are available to measure these different abilities and selection is based on prediction models which take into account the unique skill needs of particular occupations,

* Tests are more valid predictors of job performance in some jobs than others or

* Improvements in job performance measured in standard deviation units have larger effects on output valued in dollars in some occupations than others.

Hunter and Schmidt (1982) have published an estimate of the social benefits of extensive use of employment tests. They employed Brogden's (1949) formula to calculate the effect of test use on the efficiency of the economy's matching of workers to jobs. In this context Brogden's formula can be viewed as a way of representing for a specific job the derivative of a worker's true productivity (P^t_i) measured in dollars with respect to a test score (T_i):

$$(3) \quad \frac{\partial P^t_i}{\partial T_i} = \frac{\text{Cov}(P^t_i, T_i)}{\text{Var}(T_i)} = r_{TP} \frac{SD(P^t)}{SD(T)}$$

where $\text{Cov}(P^t_i, T_i)$ = the covariance of true productivity and the test in an unselected sample.

$\text{Var}(T_i)$ = the population variance of the test.

r_{TP} = true validity, the correlation between true productivity in that job and the test when employees are randomly selected.

SD(P') = the standard deviation of output in dollars if the workers had been randomly selected.

SD(T) = the population standard deviation of the test.

They pointed out that tests are more valid predictors of job performance (eg. have higher r_{TP}) in the more complex jobs that are traditionally better paid and, therefore, probably also have larger standard deviations of productivity in a dollar metric, SD(P'). When this is the case, output will increase if high scoring individuals are recruited into the most complex jobs and low scoring individuals are recruited into the less complex jobs. They made a simplifying assumption that the ratio of the standard deviation of output in dollars to the wage was the same in all jobs but argued that it was quite large, about 40 percent of salary. Under this assumption, they calculate that distributing all workers across four major occupational categories on the basis of a single measure of academic ability would raise productivity 4 percent above the level resulting from random assignment of workers to major occupational category. They also reported that assigning workers on the basis of a simple multi-variate selection model involving tests of perceptual speed and spatial ability as well as academic ability would increase productivity by 8 percent relative to random assignment.

However, since people are already recruited into high status jobs on the basis of years of schooling, SAT scores, college major, grades, previous work experience and performance in past jobs (which together explain much of the variance of test scores), greater use of tests by employers would probably have much smaller effects on national output than those calculated by Hunter and Schmidt. Hunter and Schmidt acknowledged this when they said, "Employers do not select randomly from among applicant pools.... many of these [selection] procedures have low validity, but average productivity levels associated with current methods are certainly above those that would result from random selection from applicant pools, though less effective than our univariate selection strategy (p. 270)". Michael Rothschild (1979) proposed two other sources of upward bias in their estimate. He argued that the assumption of optimal placement is unreasonable. Tests would never be used by all firms, for all jobs and optimally in every case, so the full benefits calculated would never be realized. A second source of bias, in Rothschild's view, is the possibility that errors in measuring productivity may be positively correlated with test score, and that consequently the estimates of true validity and the standard deviation of true output used in the analysis may be biased. Hunter and Schmidt argued to the contrary that their estimates are conservative because they assumed that (1) coefficients of variation of productivity are the same

for all occupations, (2) at most three test scores were used to reassign workers and (3) only 4 categories of occupations were analyzed. They have pointed out that these features of the calculation cause it to understate the effects of greater test use on national productivity.

The only way to determine whether the net effect of the offsetting biases makes the H/S estimates too high or too low is to change as many of the problematic assumptions as possible and then redo the calculation. That is what will be attempted in this section of the paper. The objective is an improved estimate of the magnitude of the efficiency gains that may result from greater test use, not a definitive estimate. In the current state of knowledge, a definitive estimate is infeasible for some important sources of bias cannot be eliminated. There is no way of knowing, for example, how effectively tests will be incorporated into selection decisions and whether the measurement errors of job performance are correlated with test scores or not, so it will not be possible to formally address two of Rothschild's objections to H/S's estimates. Most of the factors that Hunter and Schmidt argue cause their estimates to be conservative are dealt with, however, so the resulting estimates are probably upper bounds on the likely impact of greater test use on the productivity of the economy.

We saw in the previous section that different occupations appear to require different abilities and that test validity varies across occupations. The simulation exercise conducted in this section of the paper is based on empirically validated models of job performance that are quite similar to those described in section 3.3. In these models relative job performance ratings are a function of three (not five) tests score composites (general academic achievement, perceptual speed and psychomotor skills), years of schooling, age, total occupational experience, tenure, gender, race and Hispanic background for 8 different occupational categories in the United States Employment Service's General Aptitude Test Battery Revalidation Individual Data File.

Because it is illegal for firms to select workers on the basis of gender, race or ethnicity, these variables were excluded from the model used to simulate the assignment of workers to occupations. Workers were assigned to jobs on the basis of performance predictions generated by estimates of equation 1a.

(1a) $\dfrac{R^m_{ij}-R^m_{-j}}{SD_j(R^m_{ij})} = R_{ij} = \beta_0 + \beta_1(T_{ij}-T_j) + \beta_2(S_{ij}-S_j) + \beta_3(X_{ij}-X_j) + v_2$

(1b) $R_{ij} = \beta_0 + \beta_1(T_{ij}-T_j) + \beta_2(S_{ij}-S_j) + \beta_3(X_{ij}-X_j) + \beta_4(D_{ij}-D_j) + v_2$

where R_{ij} = ratings standardized to have a zero mean and SD of 1.

T_{ij} = a vector of the three GATB aptitude composites

S_{ij} is the schooling of the ith individual.

· $\underline{X}_{ij}$ = a vector of age and experience variables--age, age^2, total occupational experience, total occupational experience^2, plant experience and plant experience^2.

The calculation of the effects using GATB scores to reassign workers to occupations on aggregate output will be based on the predictions of Model 1b, a model which does include dummies for gender, race and Hispanic.

The next step is a review of the literature on how variable output is across workers doing the same job and how this variability differs across jobs. These results are presented in section 4.2. The major finding here is that the standard deviation of output is substantially higher in the more cognitively complex and better paid jobs.

In section 4.3 the effect of alternative ways of assigning workers to jobs is calculated by simulating such changes in the USES Individual Data File after reweighting it to be representative of all workers outside of professional, managerial and sales representative occupations. The parameters of the "structural" models are used to predict the productivity (in standard deviation units) during the first ten years on the job of all 31,399 workers in the data set in each of the 8 occupational categories analyzed. The mean predicted productivity of workers who currently occupy each job is then compared to the productivity that would result from (1) a random assignment of new hires to jobs and (2) a resorting of new hires across jobs based on the productivity predictions generated by regression equations similar to the structural models but absent data on gender, race and Hispanic background. These results are then translated into a dollar metric by multiplying changes in mean productivity in standard deviation units by estimates of the standard deviation of productivity in dollars obtained from the literature review. Impacts on the gender, racial, and Hispanic composition of each occupation are also simulated and discussed. Section 4.4 then concludes with a critique of the estimated "structural" models of job performance and the resulting estimates of productivity gains from resorting the workforce on the basis of employment tests and relevant occupational experience.

4.2 A REVIEW OF STUDIES OF OUTPUT VARIABILITY

A crucial determinant of the payoff to using tests to select workers is the extent of the variability across workers in their productivity on the job. A search for studies of output variability yielded 49 published and 8 unpublished papers covering 94 distinct jobs. Recent reviews of the literature on SDY by Boudreau (1987) and Hunter, Schmidt and Judiesch (1988) were the source

TABLE 6
DETERMINANTS OF RELATIVE JOB PERFORMANCE

	Yrs of Schooling	Academic Achievement	Perceptual Speed	Psychomotor Skills	Age	Age Square	Occ Exp	Occ Exp Square	Tenure	Tenure Square	R²	N
Plant Operators	-.013 (.43)	.244*** (3.89)	.112* (1.68)	.117** (2.30)	.048* (1.69)	-.00053 (1.45)	.024 (.51)	-.00039 (.28)	.096* (1.93)	-.002 (1.36)	.181	651
Technician	.028* (1.75)	.277*** (8.25)	.024 (.72)	.117*** (4.35)	-.005 (.33)	-.00008 (.36)	.041*** (2.93)	-.00097** (2.11)	.084** (5.47)	-.0023*** (3.66)	.115	2384
Craft Workers	-.017** (2.48)	.249*** (15.00)	.060** (3.36)	.079*** (5.96)	.046*** (5.86)	-.00065*** (6.51)	.046*** (8.43)	-.00034*** (2.27)	.064*** (11.37)	-.0016*** (8.60)	.141	10061
High Skill Clerical	.013 (.82)	.272*** (8.75)	.085*** (3.17)	.094*** (3.63)	.035** (2.31)	-.00051** (2.55)	.020 (1.35)	-.00017 (.36)	.117*** (7.35)	-.00316*** (5.07)	.145	2570
Low Skill Clerical	-.015 (1.28)	.296*** (11.91)	.107*** (4.43)	.092*** (4.48)	.035*** (3.46)	-.00057** (4.29)	.042*** (3.36)	-.00090** (2.15)	.095*** (6.73)	-.0027*** (4.94)	.135	4124
Service	-.024 (1.45)	.298*** (8.14)	.072** (1.96)	.138*** (4.65)	.045*** (3.43)	-.00056*** (3.28)	.084*** (5.16)	-.0022*** (4.16)	.052*** (2.70)	-.0012 (1.61)	.152	1928
Operatives & Laborers	-.049** (6.59)	.189*** (10.65)	.079*** (4.37)	.140*** (9.53)	.047*** (6.62)	-.00064*** (6.79)	.038*** (3.77)	-.00052 (1.58)	.078*** (7.38)	-.00166*** (4.65)	.137	8167
Sales Clerks	-.024 (.70)	.119 (1.34)	.118 (1.41)	.167** (2.38)	.071*** (2.63)	-.00084** (2.45)	-.009 (.26)	.0012 (1.08)	.026 (.62)	-.0008 (.50)	.087	417

of most of the data. The results are summarized in column 2 of table 7 and column 1 of table 8. (The detailed results are reported in Tables 1-4 in Appendix C). Most of the studies reviewed measured physical amounts of output produced over periods generally lasting one to four weeks and report a ratio of the standard deviation of output to mean output, coefficient of variation or CV. Relative output levels vary over time, so coefficients of variation for a one or five year period are inevitably smaller than the coefficients of variation for a one or two week period. Hunter, Schmidt and Judiesch (1988) review a number of studies which provide evidence on the correlation between output levels over time and how these correlations vary with the length of the time interval studied. This information was then used to construct estimates of the output CVs for periods of a year or more. It is these corrected estimates of the CV which are reported. For semi-skilled factory jobs paid on an hourly basis the coefficient of variation averaged about 14 percent. Output variability is greater in the higher paid technical and precision production jobs. The coefficient of variation averages 27.6 percent in craft jobs and 33.8 percent in technical jobs.

Clerical jobs were divided into high skill and low skill categories. The description of the job in the Dictionary of Occupational Titles was reviewed and jobs which appeared to require greater skill or involve discretion and decision making were classified as "high skill clerical." The jobs which were included in this category were stenographer, computer operator, administrative clerk, supply specialist, claims processor, head teller, ticket agent, customer service representative and teacher aide. Jobs categorized as "routine" were key punch operator, hotel clerk, cashier-checker, telephone operator, mail carriers, file clerks, stock clerk, typists, and toll ticket sorters. This distinction appears to be a real one for the high skill clerical jobs were generally better paid than the routine clerical jobs and the workers in these jobs scored one third of a standard deviation higher on the GATB academic achievement composite than those who occupied the more routine clerical jobs. Furthermore, the variability of job performance appears to be substantially greater in the jobs that require decision making. The coefficient of variation was 25.5 in the high skill clerical jobs and 16.7 percent in the routine jobs.

Data was available for only three service occupations. These three jobs represent too small a sample to produce reliable estimates of the CV for all service jobs except police and fire fighting so the estimate of the service CV employed in the paper is an unweighted average of the CVs for operatives, low skill clerical workers and 20.6, the average for the three service jobs for which there is data on the variability of output. For sale clerks records of sales transactions were employed to calculate the CV and the result was an estimate of 29.8 percent.

When a firm expands by hiring extra workers, it incurs significant fixed costs. It must rent

space, buy equipment, hire supervisors and recruit, hire, train, and payroll the additional production workers. If output can be increased by hiring more competent workers, all of these costs can be avoided and the firm's capital becomes more productive. These factors tend to magnify the effects of work force quality on productivity. They imply that the ratio of the standard deviation of worker productivity in dollars (SD$) to average worker compensation is much larger than the productivity CV for that job (Klein, Spady and Weiss 1983; Frank 1984).

Estimates of productivity standard deviations (SD$) in 1985 dollars are reported in column 2 of the table 7. In most cases the author of the study made no attempt to estimate SD$'s, so estimates of SD$ were derived as a product of the CV, the mean compensation for that job and 1.52, the ratio of value added to compensation for private non-farm business excluding mining, trade, finance and real estate. The value added to compensation ratio in retailing and in real estate is much too high to be used as an adjustment factor. So for all sales occupations, it was assumed that SD$ = CV times average compensation. The SD$ that result are $13,668 for technicians, $12,399 for craft workers, $5062 for semiskilled factory jobs, $8925 for high-skill clerical jobs, $4934 for routine clerical jobs, $4068 for service workers other than police and fire fighters and $5228 for sales clerks. While it is possible to debate the accuracy of specific estimates and the reliability of the 15th, 50th, and 85th percentile method of measuring SD$, the basic pattern of rapidly increasing standard deviations of output as one moves up the occupational distribution is unlikely to be disturbed by new data or a revised methodology.

What about jobs where capital equipment controls the pace of work? It has been argued that in automated continuous process industries the amount and quality of output is determined by technology and computer programs not by the skills and talents of the workers. In fact, however, programs cannot be written to handle all contingencies and machines are never completely reliable so human operators have an important role to play (Hirschhorn 1984; Adler 1986). In capital intensive industries with high rates of energy and materials consumption, small errors can cause substantial losses. Small adjustments which increase fuel efficiency can save a utility or refinery millions of dollars a week. This has been demonstrated by a very careful study of the variability of the job performance of the operators of electric utility plants(see Appendix Table B2). In the study of the operators of electric generating plants commissioned by the Edison Electric Institute, committees of technical experts were organized and asked to make consensus estimates of the frequency and costs of the most common types of operator errors. Once the relationship between specific operator errors and the purchase costs of replacement power was established, the experts estimated what would be expected (in dollar terms) from an operator at the 15th, 50th and 85th

percentile of job performance. The study concluded that the standard deviation for the productivity of control room operators is about \$278,000 in 1985 dollars at nuclear plants and \$115,000 at fossil fuel plants (Dunnette et al 1982).[6] When the results of Wroten's study of output variability among refinery operators is combined with the results of the Dunnette et al study, the estimated SD\$ for this small but very important set of jobs is \$91,020. The SD\$ of plant operators is more than 6 times larger than any of the other occupations in the USES Individual Data File. As a result, resorting to maximize total output implies that workers who would be above average producers in all occupations should be assigned to this occupation.

4.3 SIMULATION RESULTS

The question posed in this subsection is "What will happen to aggregate output and to the gender and ethnic composition of various occupations, if firms use the GATB to select new hires?" To simulate the effect of changes in the allocation of workers across jobs on aggregate output, one needs estimates of how the effects of GATB test scores and other worker characteristics on productivity vary across jobs. If the data were available, we would want to estimate, for random samples of the population, linear regressions in which the true relative productivity in dollars, P^t_{ij}-P^t_j, of the ith worker in the jth job is a function of the worker's characteristics. Unfortunately, in most studies the only indicators of productivity are supervisory ratings which are not defined on a ratio scale and have only limited reliability.

If, however, outside estimates of the standard deviation of true productivity among job incumbents, $SD_j(P^t_{ij})$, are available and assumptions are made about the measurement error in these ratings and about selection effects, estimates of the effect of test scores on true productivity in that occupation can be derived from regression models in which ratings are predicted by test scores and other worker characteristics. The measurement assumptions implicitly made by Hunter and Schmidt and most other contributors to the literature are:

$$(5) \quad R_{ij} = \frac{R^m_{ij} - R^m_j}{SD_j(R^m_{ij})} = \sqrt{r_{pp}} \; [\frac{P^t_{ij} - P^t_j}{SD_j(P^t_{ij})}] + v$$

where r_{pp} = the reliability of supervisory ratings (eg. the correlation between independent ratings by two different supervisors in the selected sample of job incumbents).

$SD_j(P^t_{ij})$ = the standard deviation of true productivity in the selected sample of incumbents in job "j".

v is uncorrelated with true productivity.

In other words, the ratings of relative job performance are assumed to be cardinal measures of productivity that are linearly related to true productivity and that errors in assessing productivity are negatively associated with true productivity. This assumption implies that measurement error in the dependent variable attenuates the true relationship. Since the upper bound on the reliability of job performance measures like the Standard Descriptive Rating Scale appears to be .6 (King, Hunter and Schmidt, 1980), the impact of a right hand side variable on true productivity in standard deviation units can be calculated by multiplying the coefficients reported in Table 5 by 1.29, the inverse of the square root of criterion reliability. It is further assumed that $SD_j(P^t_{ij})$ is equal to the $SD\$_j$, the standard deviation of productivity in dollars discussed in section 4.2. While these assumptions may seem reasonable, there do not appear to be any studies which have demonstrated that errors in assessing job performance are negatively correlated with true productivity and only a few studies establishing the reasonableness of the assumption that $SD_j(P^t_{ij}) = SD\$_j$ (Vineberg and Taylor 1972; Corts et al. 1977; Trattner et al 1977). To facilitate comparisons with previous literature, the calculations of output effects presented below are based on the assumptions detailed above.

The second problem that must be dealt with is the downward bias on estimated coefficients that results from the fact that incompetent workers are fired and high performing workers are promoted to jobs of a higher classification. As already discussed, this bias can be adjusted for by multiplying all coefficients by 1.76. The reader is reminded that while these corrections deal with some bias problems, others remain, so even with these corrections the simulations presented below are not definitive. The likely effects of the biases that remain will be discussed after the simulation results are presented.

The Productivity Loss from Random Assignment of Workers to Jobs

The first simulation exercise is a comparison of the mean predicted productivity of workers who currently occupy each job to the productivity that would result from a random assignment of new hires to jobs. The parameters of the equation 1b model were used to predict the productivity (in standard deviation units) during each of the first ten years on the job of all 31,399 workers in the data set in each of the 8 occupational categories analyzed.

(6) $R_{ijt} = \beta_{j1}T_i + \beta_{j2}S_i + \beta_{j3}X_{it} + \beta_{j4}D_i + C_j$

where $X_{it}' = $ a vector of age and total occupational experience variables:
$(age_i - tenure_{ij} + t)$, $(age_i - tenure_{ij} + t)^2$,
(total occupational experience$_{ij}$ - tenure$_{ij}$ + t), and
(total occupational experience$_{ij}$ - tenure$_{ij}$ + t)^2.

tenure$_{ij}$ = the plant experience of the ith worker in the j^i_h job/establishment at the time of the GATB study.

t = time since being hired. It ranges from 0 to 10.

total occupational experience$_{ij}$ - tenure$_{ij}$ is the worker's experience in the occupation prior to coming to work at the establishment. If the worker is reassigned to a different broad occupational category, this previous occupational experience is set at zero.

The effects of age and previous occupational experience at the time of hire were included along with test scores, schooling, gender and ethnicity. An annualized present discounted value of each worker's predicted productivity during the first ten years was then calculated under the assumption of a 6 percent real interest rate and a monthly turnover rate of 1 percent (which yields a yearly retention rate of .8869).

(7) $\quad APV_{ij} = \sum_{t=5}^{9.5} R_{ijt}(.8869/1.06)^t / \sum_{t=5}^{9.5} (.8869/1.06)^t$

Based on occupation, race and Hispanic status, each worker was assigned a weight so that the USES Individual Data File would become representative of all 71,132,000 workers in these 8 occupations. The weighted mean annualized present value of predicted productivity resulting from random assignment of new hires to occupations was then subtracted from the weighted mean annualized present value of predicted productivity during the first ten years on the job for the current set of individuals in that occupation. This was then translated into dollars by multiplying first by 1.29, second by 1.76 and then by the SD$$_j$ for that occupation.

The results of this simulation exercise are presented in Table 7. *The loss in productivity that would result from random assignment of workers to jobs is estimated to be about $1800 dollars per worker per year or 8 percent of mean compensation. The aggregate yearly loss is $129 billion in 1985 dollars.* The reductions in productivity primarily occur because: (1) workers who had higher than average productivity during their early years at the firm due to previous experience in the occupation are often randomly assigned to an occupation where this previous experience is of no value and (2) workers with high test scores are much less likely to be assigned to high skill jobs which use their talents than is the case currently. These results are clearly an extreme lower bound estimate of the benefits (relative to random assignment) of the current process of matching workers to jobs. If other worker characteristics such as occupationally specific education, tastes and talents for particular occupations and performance in previous similar jobs had been included in the model, estimates of productivity loss resulting from random assignment of workers to occupations would have been substantially greater.

Table 7

LOSS IN PRODUCTIVITY IF RANDOM ASSIGNMENT WERE SUBSTITUTED FOR THE CURRENT ALLOCATION OF WORKERS [LOWER BOUND ESTIMATE]

	Average Compensation per FTE	Standard Deviation of Output	Loss Per Worker	Number of Workers (1000's)	Aggregate Loss (billions)
Plant Operators	$33,808	$91,020	-$9,652	228	-$ 2.3
Technicians	$26,649	$13,668	-$8,672	5261	-$45.6
Craft Workers	$29,655	$12,399	-$3,700	13073	-$48.4
High Skill Clerical	$23,065	$ 8,925	-$4,914	5227	-$25.7
Routine Clerical	$19,472	$ 4,934	-$1,512	12082	-$18.3
Service Exc. Police & Fire	$15,496	$ 4,068	+$ 889	13445	$12.0
Operatives & Laborers	$23,828	$ 5,062	+$ 250	16816	$ 4.2
Sales Clerks	$17,542	$ 5,228	-$ 723	5682	-$ 4.0
All Workers	$22,566	$ 6,708	-$1,781	71,853	-$128.0

Estimates compare the predicted productivity of current members of each occupation with the mean predicted productivity in that occupation of everyone in the USES data set. Predicted job performance was calculated using equation b, the best fitting model of job performance which included individual variables for gender, race and Hispanic. Dollar impacts were then calculated by first adjusting for the unreliability of the criterion in the standard manner (i.e. dividing by $\sqrt{.6}$), then correcting for restriction of range by multiplying by 1.76 and then multiplying by the standard deviation of output in dollars (column 2 of Table 7).]

The Productivity Gains from Re-Sorting Workers on the Basis of Test Scores

The effect of greater use of employment tests to select workers on productivity was explored by simulating the effects of reassigning new hires on the basis of the productivity predictions derived from equation 1a. An annualized present discounted productivity (averaged over the first ten years on the job) was calculated for each worker in each occupation. The reassignment scheme employed a variant of the "cut and fit" or successive selection technique (Thorndike 1949; Guion 1965). The 8 occupations were arrayed in a hierarchy according to the magnitude of the dollar change in productivity that results from a unit change in academic achievement. Plant operators were at the top of the hierarchy. The computer program sorted all workers by the present discounted value of their predicted productivity as plant operators (based on equation 1a, the model that excludes dummy variables for race, Hispanic and gender) and then assigned just enough people from the top of that ranking to fill all 228,000 of the nation's plant operator jobs. The remaining workers were then sorted by their productivity in technical occupations and those found at the top of the ranking were assigned to these occupations until all 5,261,000 technical jobs were filled. This procedure was repeated next for craft jobs, then for high skill clerical jobs, for low skill clerical jobs, for service jobs, and for operative jobs. Those left over after operatives were selected became sales clerks.[7]

The simulated productivity effects of hiring workers on the basis of test scores and previous occupational experience are presented in Table 8. Output rises by $1561 per worker per year or by 6.9 percent of mean compensation. The total gain from applying this plan to the 71 million workers represented in the data base is $111 billion per year. There are major improvements in the productivity of plant operators, technicians and craft workers which more than offset large declines in the productivity of operatives and sales clerks.[8]

The Social Cost of Testing

The testing is costly, however, so the net benefits of greater testing will be somewhat smaller. The firm's costs are generally assumed to be about $10.00 per administration. The tests generally take 3 hours to take, so I will assume that the value of the job applicant's time is $24.00 on average. If each employer were to do its own testing and to test 10 applicants for every position filled, the total yearly costs of the testing would be $10.7 billion [.48*10*$34*(71,132,000-5,682,000) assuming a monthly new hire rate of 4 percent and no testing of sales clerks]. An alternative approach which reduces the testing burden would have labor market intermediaries or testing organizations (eg. the Employment Service, private employment agencies, the Educational

Table 8

THE EFFECT OF RE-SORTING
ON AGGREGATE OUTPUT
[UPPER BOUND ESTIMATE]

	Coefficient of Variation	Impact of Resorting on Average Output		Aggregate Gain (billions $)
		Percent	Dollars	
Plant Operators	---	---	$159,282	36.3
Technicians	33.8	17.8	$ 12,667	66.7
Craft Workers	27.6	7.1	$ 5,623	73.6
High Skill Clerical	25.5	.9	$ 579	3.0
Routine Clerical	16.7	.6	$ 190	2.3
Service Exc. Police & Fire	17.3	1.3	$ 537	7.2
Operatives & Laborers	14.0	-3.4	-$ 2,152	-36.3
Sales Clerks	29.8	-23.8	-$ 7,322	-41.5
All Workers			$ 1,549	111.3

Estimates compare the predicted productivity of current members of each occupation with the predicted productivity of those assigned on the basis of equation 1a which does not make use of information on gender and ethnicity. Equation 1a performance predictions were made for each occupation and each worker. Because the standard deviation of output measured in dollars of plant operators was so high, this occupation got first pick. Then came technicians, craft occupations etc. Those not selected for one of the top 7 occupations became sales clerks. Once workers were assigned to occupations on the basis of equation 1a, predicted job performance was then calculated using equation 1b, the best fitting model of job performance which included individual variables for gender, race and Hispanic. Dollar impacts were then calculated by first adjusting for the unreliability of the criterion in the standard manner (i.e., dividing by $\sqrt{.6}$), multiplying by 1.76 to correct for range restriction and then multiplying by the standard deviation of output in dollars (column 2 of Table 5).]

Testing Service) administer the battery of employment tests and then report the scores to potential employers when requested by the worker. Twenty seven percent of the work force change jobs in a year (Horvath 1981). If each job changer were to take 3 tests on average and one fifth of those with more than a years tenure were tested yearly as well, the total yearly costs of testing would be $2.3 billion [$34(.27*3+.73*.2)*71,132,000]. *The projected social costs of administering the tests, therefore, probably lie somewhere between 2 and 10 percent of the projected social benefits.*

The Distributional Effects of Resorting on the Basis of Test Scores

The simulated effect of the reassignment scheme on the mean test scores, schooling and demographic character of each occupation is presented in the even numbered columns of Table 9. The characteristics of those who are currently in each occupation are presented in the odd numbered columns. Currently workers in technical and high skill clerical occupations have the highest academic achievement and operatives and service workers have the lowest. The simulation results in the workers with the strongest academic achievement being reassigned to plant operator, technical and craft occupations and the workers with the weakest academic achievement being reassigned to operative and sales clerk occupations. Some of the changes are truly dramatic--the mean test score of plant operators rises by 2 population standard deviations and the mean score of sales clerks falls by 1.6 population standard deviations. This outcome is a result of placing the plant operator occupation at the top of the hierarchy and the sales clerk occupation at the bottom. The simulation also produces an increase in the schooling of plant operators and a decline in the mean schooling of sales clerks.

Reassigning workers on the basis of test scores, age and previous work experience but not gender or ethnicity produces large changes in the demographic composition of some occupations. Women end up with most (77 percent) of the plant operator jobs and roughly half of the craft jobs. Occupations which have historically been predominantly female become more evenly split between men and women. Occupational segregation of female workers into low paid jobs is just about eliminated and this dramatically raises their wage. As one can see in Table 10, the wage of female workers goes up by 15 percent and the wage of male workers falls by 3.6 percent. Note that the gain for women is much larger than the loss for men. This occurs because the better match of worker talents and job requirements raises aggregate productivity by 7 percent.

In effect, the simulation assumes that all affirmative action programs designed to give under represented minorities hiring preference or even the benefit of the doubt have been canceled, For affirmative action and the other selection strategies now being used, it substitutes a criterion of

Table 9

THE EFFECT OF THE RE-SORTING
ON THE ABILITY, GENDER AND ETHNICITY
OF OCCUPATIONS

	General Ability (Pop SD's)		Education		Percent Female		Percent Black		Percent Hispanic	
	Current Level	Change	Current Level	Change	Current Level	Change	Current Level	Change	Current Level	Change
Plant Operator	.09	+2.03	12.1	2.09	2	+75	11.1	-11	5.1	-5
Technician	.28	1.03	13.7	.22	55	+1	8.1	- 6	3.4	-1
Craft	-.09	.65	11.9	.53	4	+43	7.1	- 4	7.4	-3
High Skill Clerical	.32	.02	12.9	.67	83	-16	10.1	- 4	5.4	-1
Low Skill Clerical	.00	.03	12.6	-.48	82	-18	10.6	- 4	5.7	0
Service Exc. Police & Fire	-.52	.12	11.8	.01	82	-14	18.0	- 6	8.3	0
Operative	-.59	-.46	11.3	-.01	66	0	14.7	+ 7	10.0	+2
Sales Clerk	-.02	-1.59	12.3	-1.00	86	-20	8.2	+24	5.6	+3
All Occupations	-.21		12.1		62		11.9		7.3	

This table reports the gender, ethnicity, schooling and test scores of current members of each occupation and the changes in each of these variables that would result if new hires had been selected on the basis of the equation IQ predicted productivity regressions (which ignore race and ethnicity). The simulation was conducted by first calculating the equation IQ performance predictions for each worker in each occupation. Because the standard deviation of output measured in dollars of plant operators was so high, this occupation got first pick. Then came technicians, craft occupations etc. Those not selected for one of the top 7 occupations became sales clerks.

"select the person with the highest predicted productivity based on test scores, schooling, age and work experience". This radical change in selection criteria has two offsetting effects on minority workers. The first effect is that minority representation decreases in plant operator, technical, craft, clerical and service occupations and increases in operative and sales clerk occupations. Changes in the occupational composition of the Hispanic work force are substantially smaller than the changes for black workers, but they are in the same direction.

The second effect is an increase in the wages of black and Hispanic workers. This occurs because the reductions in the relative wages of blacks and Hispanics resulting from some being reassigned from craft and technician occupations to operative and sales clerk occupations are quite small (3.5 to 4 percent) and are consequently outweighed by the 6.9 percent increase in aggregate output that results from the better matching of workers to jobs. There are two reasons for the small size of the decline in the relative wage of minority workers. The first is that the number of people transferred to an occupation with a lower average wage is not as large as might have been anticipated. This is particularly true for Hispanics. In part this is because blacks and Hispanics are already under represented in technical, craft and high skill clerical occupations. The qualifications of minority job applicants are often weaker and they are sometimes the victim of unflattering stereotypes.[10] The more important reason for the small impact on relative wages is the rather low correlation between occupational wage levels and rank in the occupational hierarchy used in the simulation. Even though its wages were above average, the operative occupation was assigned a low rank in the selection hierarchy because job performance is less variable and academic achievement is relatively less important determinant of job performance in this occupation. The result is that the increase in minority representation in operative occupations produced by the simulation actually raises their relative wage.[11]

Comparison with Hunter and Schmidt

How do these results compare to those of Hunter and Schmidt (1982)? The estimated total effect of going from random selection of new hires to optimal use of tests, age and previous work experience is 15 percent of the compensation of workers subject to reassignment. This is much larger than the 8 percent figure H/S obtain in their three test score selection model when SD$ is 40 percent of each occupation's mean compensation. The reasons for the difference are: (a) the estimates of differences in SDY across occupations are much larger than the one's assumed in their simulation, (b) the restriction of range correction (which was based on actual data on the reductions in job performance variance resulting from the selective nature of turnover) is larger than the one

Table *10*

Effect of Resorting on
Mean Wages

All Workers	**+ 6.9%**
Female Workers	**+15.0%**
Male Workers	**- 3.6%**
Black Workers	**+ 4.0%**
Hispanic Workers	**+ 3.6%**
Non-Black, Non-Hispanic Workers	**+ 7.6%**

they assumed, (c) job assignment is based on a composite of test scores, schooling, age and previous occupational work experience that has greater validity than test scores alone and (d) 8 rather than 4 occupational categories are analyzed.

4.4 A Critique of the Simulations

The simulation results just presented are based on a maintained assumption that the models of relative job performance described in section 3.3 (which were estimated in samples of job incumbents) are, after the correction for errors in measurement of the criterion and the selective nature of turnover (ie. restriction of range), unbiased estimates of true population relationships. We have already pointed out that the underlying performance model is probably biased by omitted variables and the selection process that determines which members of the population are hired for the job. What effect do these biases have on the forecasted effects of increased use of the GATB.

Controls were lacking for worker characteristics which are often known by hiring decision makers and which are associated with worker productivity. Clearly, if random assignment of new hires to jobs involved ignoring all of this additional information as well as information on schooling and years of experience in the occupation, the loss in productivity would be substantially larger than the numbers reported in table 7.

The omission of many important determinants of job performance also biases the simulations of the impact of greater test use. If these variables had been included in the job performance models, the coefficients on test scores would probably have been smaller and adding test scores to the factors considered in hiring selections would have resulted in fewer workers being reassigned. This in turn reduces the output gain that results from greater use of employment tests for selection and exaggerates the predicted changes in demographic composition of occupational work forces.

The other source of problems is selection effects. The selectivity bias caused by turnover and promotion decisions that depend on realized levels of job performance has already been discussed and corrected for. It is the selectivity bias introduced by the selection that precedes the hiring decision which causes the problem. For the reasons discussed in the previous section, this prior selection causes our simulations to exaggerate the predicted effects of greater use of the GATB. If the simulations had been conducted using the true structural model of job performance rather than the biased one that was available, fewer people would have been reassigned and productivity gains would have been smaller.

Still another limitation of the simulations is that they took no account of turnover risks. The large effects of tenure on the productivity of plant operators, technicians and craft workers

implies that specific training is particularly important in these occupations and that minimizing turnover should be an important goal of a firm's hiring selections. Some of the workers assigned to plant operator jobs in the simulation might have been college students working part time who would have been unlikely to remain long in the job.

Greater use of employment tests is not the same thing as greater use of the GATB. The GATB lacks measures of technical, scientific and advanced mathematical competence and is, therefore, not the best employment test available. If these subtests were added to the GATB there would be a substantial increase in validity and classification efficiency (eg. workers with a strong technical background would be assigned to craft jobs rather than clerical jobs and workers strong in math and English but weak in the technical arena would be assigned to clerical jobs). If a fully optimal sorting routine had reassigned workers across 100 occupations on the basis of a test battery with separate verbal, mathematical and technical ability as well a perceptual speed and psychomotor ability, the sorting efficiency gains would have been considerably larger than those simulated. These different abilities are not all that highly correlated and studies of the classification problem in the military find that important increases in utility result when recruits are optimally assigned to jobs on the basis of a test battery like the ASVAB.

On the other hand, Mike Rothschild is correct when he argues that there are many barriers to the complete reshuffling of the work force that would be necessary for employment testing to have its maximum effect (the effect that is simulated in Table 8 and 9). Employers would have to become much better informed about employment testing. If they all sought advice from industrial psychologists, long queues would result and consulting fees would skyrocket. If a number of worker aptitudes are to be reliably measured, a couple of hours must be devoted to the testing. This would impose a burden on job seekers in some high turnover labor markets and some low wage industries would, consequently, eschew testing altogether. The simulation model did not ask the workers who were being transferred whether they wanted the higher paying jobs. Some would have refused. The simulation ends gender segregation of occupations and makes wholesale transfers of clerical workers to plant operator and craft jobs. Improved structural models would probably reduce the size of these shifts, but even more modest shifts would be difficult to pull off. Affirmative action goals and/or the use of race normed test scores in selection would also eliminate the sorting impacts of greater test use on Blacks and Hispanics. Clearly, the EEOC regulation of employment testing is not the only barrier to a more efficient allocation of workers across jobs and many of these other barriers would have to fall before testing could have its full

effect. Consequently, the likely productivity benefits and resorting effects of allowing employers a free hand with regard to employment testing are smaller than those presented in Table 8.

Nevertheless, the simulations imply that the improvements in the matching of workers to jobs resulting from increased employment testing will significantly increase output. The 6.9 percent figure might fall to 2 or 3 percent of employee compensation once one takes the biases and the barriers to universal adoption of employment testing into account. The actual changes in the racial and gender composition of particular occupations would also be much smaller than simulated. On the other hand, taking constraints off the use of tests will also reduce tryout hiring and turnover and increase investment in specific human capital. These effects were not part of the simulations. Since total compensation of labor exceeded $3 trillion in 1988, applying the 2 to 3 percent estimate to the nation's entire workforce implies that the productivity gain from unconstrained employment testing would eventually increase gross national product by 60 to 90 billion dollars per year or between 1 and 2 percent of GNP. These effects would not arrive suddenly for the tests only influence hiring decisions. Current employees would not be fired and replaced by new hires selected on the basis of tests because the gains from better selection will seldom be sufficient to justify firing employees who have developed firm specific skills. It would, therefore, be a decade before the full effect of testing on the allocation of workers to jobs would be realized.

I conclude, therefore, that greater use of employment tests for selection would generate very large social benefits. The longer the full scale implementation of a VG-GATB system of some type is delayed, the greater will be the loss of current and future GNP. The simulations imply that the undiscounted cost of a one year delay in the wide-spread adoption of selection systems based on work experience and aptitude tests is probably more than $60,000,000,000. Consequently, it is very important to settle the legal and political controversy over the adverse impact/racial preference issue as speedily as possible so that the ES may resume the use of the GATB in making job referrals.

The National Academy's Committee on the General Aptitude Test Battery (1989) recommended that the use of the GATB continue while improvements were being made. The political and legal controversy over within group scoring appears to have caused the Department of Labor to reject the National Academy's advise and to propose instead a two year moratorium on the use of the GATB while research is conducted which it is hoped will resolve the controversy (Department of Labor, July 24, 1990). This is a false hope. The issue must be decided on political, legal and ethical grounds, not scientific grounds. No amount of scientific research or further development work on the GATB can make the dilemma go away.

The proposals for improvements in the VG-GATB job referral system made in Chapter 5 and 6 would reduce adverse impact, but it does not eliminate it.

The dilemma arises from the fact that competence in reading, writing, mathematics and problem solving make people more productive. One would have to search long and hard to find a well paying attractive job for which this statement is not correct. Sadly, educational achievement of Black and Hispanic minorities is not on average as strong as it is for the remainder of the population. The gap is closing but significant mean differentials remain and this puts minorities at a competitive disadvantage in the labor market.[12] The conclusion of the National Academy report (1989) was:

> *The use of a regression equation based on the combined group of black and nonminority workers would generally not give predictions that are biased against blacks. Insofar as the total-group equation gives systematically different predictions, it is somewhat more likely to overpredict the performance of blacks than to underpredict (p. 253).*

In other words, the predictions these systems make that members of minority groups who receive low scores on tests assessing verbal and mathematical competence will be less productive on the job are on average correct. If it is administered in a color blind manner, any system which uses employment aptitude tests to select new hires will result in minority group workers being less prevalent in the higher paying more prestigious jobs where these competencies are needed the most. This should not surprise anyone, this is also the outcome of the current non test based system of selecting workers.[13] It is also the consequence of selecting new hires on the basis of interviews, job knowledge tests, performance assessments such as typing speed, previous work experience, and reasons for leaving previous jobs. With respect to their effects on the advancement of minorities, the differences between selection methods are only matters of degree not of kind or of principle. Thus, the dilemma is not caused by the use of employment tests, it is caused by the desire to hire the most productive worker possible. If an employer's right to use colorblind assessment instruments to select the most qualified worker that can be found is to be preserved, the only way out of the dilemma is to redouble efforts to improve the skills of minority workers by offering job training and upgrading the quality of the schools serving minority children.

The Employment Service is not in a position where it can resolve the conflict between the competing goals of hiring individuals with the highest predicted productivity and affirmatively acting to improve the status of minorities. The Employment Service cannot force companies to hire the individuals it refers. It is only one of many labor market intermediaries

and it loses market share if its referrals are unsatisfactory. Title VII of the Civil Rights Act and the executive order requiring affirmative action apply first and foremost to firms. There is a good reason for this. Employment Service referrals are typically only a portion of the applicants considered for a job. Adverse impact is determined by looking at the establishment's overall hiring and employment patterns not at the racial breakdown of one particular stream of job applicants. The fact that the Employment Service sent the job applicants should not and does not necessarily mean the firm has met its EEO obligations.

The employment service has been trying to facilitate the affirmative action efforts of private firms for decades. Within group scoring of VG-GATB was preceded by SATB decision rules which had the same effect. I suggest that one of the reasons why this has now become such a contentious issue is that the decision made with respect to ES referral policy will be seen as a precedent for the how Title VII and the Uniform Guidelines will be applied to firms. The National Academy Committee on the General Aptitude Test Battery made, in my opinion, a serious error in letting the issue be framed this way. The result has been a political stalemate and everyone has been made worse off by the reduction in the nation's productivity that has resulted from the delay in the implementing VG-GATB.

A compromise is needed. The Combined Rules Referral Plan recommended by the National Academy's Committee on the General Aptitude Test Battery is, in my view, the best solution (1990, p. 271). Under this plan employers would receive three candidates per opening chosen by a ranking algorithm that takes no account of race or gender and up to three additional referrals of minority applicants. Information on the unadjusted test scores would be given to the employer.

> The attraction of this approach is that it places responsibility for the composition of the work force with the employer....The Job Service is not placed in the position of appearing to relieve the employer of these decisions, an implication that some employers seem to have drawn from the VG-GATB system of referral based only on within-group scores (1989 p. 273).

Employers would also be allowed to request additional minority referrals if they are operating under an affirmative action plan developed pursuant to Executive Order 11246.[14]

The ES would simply be doing its best to encourage employers to pursue the "cast a wider net" version of affirmative action. This form of affirmative action says to employers "You are not expected to change your policy of hiring the best possible job candidate, but please expand your recruitment efforts so as to attract additional minority group members into your applicant pool." This type of affirmative action has seldom been controversial.

V. LONG TERM POLICY GOALS

The findings presented in the first four parts of the paper imply that improved signaling of worker skills and competencies to employers will have significant positive effects on productivity and standards of living. Productivity gains occur both because more valid selection procedures improve the match between workers and jobs and because the supply of workers with the talents measured by the tests or school examinations grows in response to the increase in labor market rewards for the talents. The distributional consequences of greater use of academic and occupational competencies for selecting workers are that the better jobs will go to those who studied hard in school and those who attend schools that have good teachers and maintain high standards. Women will gain more access to high paying occupations but the representation of Blacks and Hispanics in occupations where the payoff to cognitive skills is high such as plant operator, craft worker and technician will fall.[15] Adverse impacts on blacks and Hispanics can be avoided by affirmative action or by race norming the test scores. **Consequently, impacts on minority groups should not be the basis for deciding whether to use an employment test or which test to use. Other instruments are available for achieving employer and societal goals regarding integration on the job and the representativeness of a firm's workforce. When, however, it comes to generating incentives to develop the skills needed on the job and efficient matching of workers with talents to jobs, there is no other selection instrument that will sort efficiently while generating the correct incentives quite as well as measures of verbal, mathematical and technical competence. These are the two criteria--incentives and sorting efficiency--by which alternative employee selection policies should be evaluated.** *That is the task undertaken in this section of the paper.*

Sorting efficiency will tend to be maximized when the employment tests used in selection for a particular occupation measure developed *abilities which have a uniquely high productivity payoff in that occupation (eg. mechanical comprehension for maintenance and repair occupation). In other words, selection/classification protocols should attempt to encourage workers to enter occupations in which they have a comparative advantage. Tests should be used but they should supplement not displace consideration of other factors such as personality, physical strength and occupationally relevant training and experience. If most of the people hired into an entry job move up to other more responsible positions, the criteria applied at the port of entry needs to take the higher level jobs into account.*

The analysis presented in section 1 of the paper implies that student incentives to learn and parental incentives to demand a quality education are maximized when the following is true: (1)

significant economic rewards depend directly and *visibly* on academic accomplishments, (2) the accomplishment is defined relative to an *externally imposed standard of achievement* and not relative to one's classmates, (3) the reward is received immediately, (4) everyone, including those who begin high school with serious academic deficiencies, has an *achievable goal* which will generate a significant reward and (5) progress toward the goal can be monitored by the student, parents and teacher.

We will see shortly that it is not easy to design a system of signaling and certifying academic achievement which satisfies all of these requirements. Consequently, it will generally be desireable to use more than one signal of academic achievement and to use different signals when selecting for different jobs. Let us examine the alternatives.

Diplomas:

High school diplomas and college degrees are effective devices for generating incentives to enroll in school. The standard high school diploma does not, however, generate incentives to attend regularly or to study hard and thus it fails requirement # 1, the most critical requirement of all. Establishing a minimum competency level for receiving a high school diploma only slightly improves incentives. Some students arrive in high school so far behind and the consequences of not getting a diploma are so severe, minimum competency standards are not set very high (and cannot in good conscience be set too high given the constraints on the system). Once they satisfy the minimum, many students stop putting effort into their academic courses.

Schooling is a valid predictor of job performance but to a great degree its validity derives from its correlation with measured verbal, mathematical and technical competence. The evidence on its incremental contribution to validity once test scores are controlled is more mixed. The analysis of GATB revalidation data presented in section 3 found the effect of schooling to be very weak but this is probably an artifact of selection bias (Mueser and Maloney 1988). Selection into the military is based explicitly on the test scores and high school graduation, not on unobservables as in the civilian sector. Since selection is based on X variables, selection effects can be corrected for (Dunbar and Linn 1986). Analysis of military data finds that high school graduation has its own unique impacts when test scores are controlled. Weiss's (1985) study of Western Electric employees found that completing high school is a valid predictor of low absenteeism and low turnover but not job performance. Thus even when studies find that graduating from high school has little effect on job performance, it appears to effect retention. **Consequently, from a sorting efficiency point of view, the high school diploma belongs on the list of credentials considered by employers even**

when tests assessing verbal, mathematical and technical competencies are available. The current VG-GATB system does not incorporate educational credentials in the ranking algorithm, but does allow employers to request that referrals have particular educational qualifications. The revised VG-GATB system should include a biodata form designed to measure educational accomplishments relevant to specific occupations and occupationally specific training. It would continue the practice of allowing employers to specify educational requirements, but would also include information from the biodata form in the ranking algorithm.

Competency Profiles:

Competency profiles (or Training Achievement Records in the Job Corps) are check lists of competencies that a student has developed through study and practice. The ratings of competence that appear on a competency profile are relative to an absolute standard, not relative to other students in the class. By evaluating students against an absolute standard, the competency profile prevents one student's effort from negatively affecting the grades received by other students. It encourages students to share their knowledge and teach each other.

A second advantage of the competency profile approach to evaluation is that students can see their progress as new skills are learned and checked off. The skills not yet checked off are the learning goals for the future. Seeing such a check list getting filled up is inherently reinforcing.

With a competency profile system, goals can be tailored to the student's interests and capabilities, and progress toward these goals can be monitored and rewarded. Students who have difficulty in their required academic subjects can, nevertheless, take pride in the occupational competencies that they are developing and which are now recognized just as prominently as course grades in academic subjects. Upon graduation, the competency profile is encased in plastic and serves as a credential certifying occupational competencies. If the ratings by teachers (and the sponsoring employers of cooperative education students) are reliable indicators of competence, employers will find this information very valuable, and the students who build a good record will benefit.

Many occupational training programs currently use competency profiles both to structure instruction and as a system for articulating with the labor market and further training. Unfortunately, however, most institutions do not view mailing out profiles to prospective employers as part of their responsibility. There is a great deal of geographic variation in the format of these documents, the skills and competencies that are assessed and the competency standards used. In many cases only occupational skills are assessed by the profile. These problems make it more

difficult for employers to use these profiles and reduces their ability to aid a student's job search. **Some thought needs to be given to how to include more generic competencies such as numeracy and writing in these profiles, how some standardization can be achieved, how they can be made more accessible and useful to employers, and how they might be incorporated into an ES referral system.**

Hiring Based on Grades in High School:

Using grades to select new hires results in a very visible dependence of labor market outcomes on an indicator of academic accomplishment. There are, however, two disadvantages. It results in zero-sum competition between classmates and consequently contributes to peer pressure against studying and parental apathy about the quality of teaching and the rigor of the curriculum. The second problem is that it induces students to select easy courses and thus tends to cause grade inflation. These problems can be mitigated somewhat if employers take the rigor of courses into account when evaluating grades, give preference to schools with tough grading standards, and vary the number hired from particular schools in response to the actual job performance of past hires from that school.

From the sorting point of view, the disadvantage of high school GPA is that it has low validity when there are no adjustments made for grading standards and it is difficult for employers to make such adjustments.[16] **Nevertheless, the ES should obtain data on GPA's, grades in particular subjects and extracurricular activities and incorpoarate this information in its job performance prediction algorithms.**

Job Tryout and Promotions Based on Performance:

From the point of view of motivating students to study, the problem with job tryout and performance reward systems is that the dependence of labor market outcomes on academic achievements is both invisible and considerably delayed.

From the efficiency point of view, the disadvantages of job tryout are the costs of training workers who end up being fired, its unpopularity with workers who will spend months unemployed if they are fired, and its potential for generating grievances.[17] Performance evaluations are known to be unreliable, and this makes workers reluctant to take jobs in which next year's pay is highly contingent on one supervisor's opinion. Pay that is highly contingent on performance can also weaken cooperation and generate incentives to sabotage others. The benefits of performance reward systems are that they motivate better performance, they tend to attract high performers to the firm,

and they tend to induce the high performers to stay at the firm. When these factors are balanced, it appears that most workers and employers choose compensation schemes in which differentials in relative productivity result in relatively small wage differentials (Bishop 1987a). **I conclude that while all new hires are to some degree on probation during the first months on a job, it would be quite inefficient for firms to use job tryouts as their sole mode of selecting new hires.**

Work Samples and Job Knowledge Tests:

From the point of view of sorting efficiency, job performance assessments and job knowledge tests have much to recommend them for they maximize classification efficiency--the assignment of job seekers to jobs which make use of already acquired skills. They are clearly job related so they seldom are challenged on EEO grounds. They are particularly appropriate if applicants vary in their knowledge and background in the occupation and training costs are substantial. If new hires are likely to be quickly promoted into higher level jobs, the job knowledge test should also cover the skills required in these jobs. Job knowledge tests are less useful when none of the applicants has experience in the field and training costs are low.

From the point of view of learning incentives, the disadvantage of assessing job performance and job knowledge is that it generates no incentives to study history and literature and generate incentives to study math and science only occasionally (i.e. when the student expects to seek a technical job and the job knowledge tests for the job contains math and science questions relevant to the job). If they were the only method of selection for most jobs, students might be induced to over-specialize if job knowledge tests were the only selection criteria of most employers. If at some point in their career a job in the field for which they prepared is not available, they might be left high and dry. This is not a real danger, however, because indicators of competence mathematics and communication can easily be used in conjunction with job knowledge tests.

General Aptitude Test Battery (GATB)-as currently constituted:

The cognitive subtests of the current GATB measure only a limited number of very basic skills--vocabulary, reading, arithmetic computation and reasoning. There are no sub-tests measuring achievement in most of the subjects in the standard high school curriculum--science, history, social science, algebra, high school geometry or trigonometry. Greater use of the GATB to make hiring selections would strengthen incentives to learn arithmetic and English but would not strengthen incentives to study other high school subjects. Consequently, hiring on the basis of the GATB fails requirement # 1.

On the other hand, a large body of research suggests that the cognitive subtests of the GATB are valid predictors of job performance in many private sector jobs (Hunter 1983). The results of our analysis suggest that greater use of the GATB in selection decisions would yield substantial sorting efficiency gains. We have seen, however, that other selection methods--broad spectrum achievement test batteries are able to achieve at least as efficient sorting outcomes as the GATB and generate much better incentive effects.

Broad Spectrum Achievement Tests Batteries:

From the point of view of incentives to study a broad range of academic subjects, broad spectrum achievement test batteries such as the ASVAB are the best of the alternatives reviewed so far. If some of the subtests in the battery included material covered in courses such as algebra, statistics, chemistry, physics and computers, the use of such tests for selection would generate parental pressure for an upgraded curriculum and encourage all high school students to take more rigorous courses. When many employers use achievement tests to select new employees, everyone who wants a good job faces a strong incentive to study, and those not planning to go to college will find the incentive especially strong. The best paying firms will find they can set higher test score cutoffs than low paying firms, so the reward for learning will become continuous. Whether one begins 9th grade way behind or way ahead, there will be a benefit on the margin to studying hard for it will improve one's job prospects.

Broad spectrum achievement test batteries covering science, computers, mechanical principles, economics, business practices and technology as well as mathematics, reading and vocabulary also maximize sorting benefits as well. Test batteries which cover the full spectrum of knowledge and skills taught in high school are more valid predictors of job performance than tests which assess math and verbal skills only. Evidence for this statement comes from examining the relative contributions of various subtests to the total validity of the ASVAB battery. Maier and Grafton's (1981) analysis of hands-on measures of the job performance for Marine Corps recruits found, for example, that validity (corrected for restriction of range) was .46 for auto shop information, .50 for mechanical comprehension, .51 for electronics information, .51 for general science, .50 for word knowledge, .52 for mathematics knowledge, and .51 for arithmetic reasoning. Tests measuring electronics, mechanical, automotive and shop knowledge--material that is generally studied only in vocational courses--have high validity. Analyzing this and other military data sets, Hunter, Crosson and Friedman (1985) concluded that the "general cognitive ability" construct that best predicted performance in all military jobs included subtests in general science, electronics information,

mechanical comprehension and mathematics knowledge as well as conventional word knowledge and arithmetic reasoning subtests. The addition of these four subtests to the construct increased validity by 11 percent and the proportion of true job performance variance explained in the Maier and Grafton data from .306 to .372 (Hunter, Crosson and Friedman, 1985, Table 19).

Broad spectrum achievement test batteries also improve classification efficiency. The technical subtests of ASVAB are important predictors of hands-on measures of job performance in technical and maintenance jobs but did not contribute to the prediction of performance in clerical jobs. Verbal subtests contributed to clerical performance but did not correlate with performance in many of the other jobs in the study. Tests measuring understanding of computers, business, economics, marketing and psychology would probably similarly improve the validity of batteries used to select workers for most white collar jobs in the private sector. The conclusion that follows from this analysis is that, on both sorting and incentive grounds, broad spectrum achievement test batteries are better devices for selecting workers than the cognitive subtests of the GATB.

To speed the transition to broad spectrum achievement test batteries, the GATB (which has not changed appreciably since 1950) should be revised. Subtests similar to the technical, mathematical knowledge and science subtests of the ASVAB or the NAEP should be added and the ranking algorithm revised to reflect military research. The employment service should also undertake a major study of the validity of the new GATB in the full spectrum of civilian jobs and undertake to develop subtests assessing knowledge of business, marketing and computers.

To maximize the incentive effects, it is essential that students, parents and teachers be aware that assessment of verbal, mathematical and technical competence will influence who gets the best jobs. The Department of Labor should seek to publicize the growing employer use of broad spectrum achievement tests for selecting workers for jobs.

Performance on Achievement Exams Taken at the End of Secondary School

In Canada, Australia, Japan and most European countries, the educational system administers achievement test batteries (eg. the 'O' and 'A' Levels in the UK, the Baccalaureate in France) which are closely tied to the curriculum. While the Japanese use a multiple choice exam, all other nations use extended answer examinations in which students write essays and show their work for mathematics problems. Generally, regional or national boards set the exam and oversee the blind grading of the exams by committees of teachers.[14] These are not minimum competency exams. In many subjects the student may choose to take the exams at two different levels of difficulty. Excellence is recognized as well as competence. In France, for example, students who pass the

Baccalaureate may receive a "Tre's Bien", a "Bien", an "Assez Bien" or just a plain pass. These exams generate credentials which signal academic achievement to all employers and not just the employers who choose to give employment tests. The connection between one's effort in school and performance on these exams is clearly visible to all. Consequently, school sponsored achievement exams like those used in Europe would have much stronger incentive effects than employer administered broad spectrum achievement tests.

This approach to signaling academic achievement has a number of advantages. Because it is centralized and students take the exam only once, job applicants do not have to take a different exam at each firm they apply to and the quality and comprehensiveness of the test can be much greater. There is no need for multiple versions of the same test and it is much easier to keep the test secure. By retaining control of exam content, educators and the public influence the kinds of academic achievement that are rewarded by the labor market. Societal decisions regarding the curriculum (eg. all students should read Shakespeare's plays and understand the Constitution) tend to be reinforced by employer hiring decisions. Tests developed solely for employee selection purposes would probably place less emphasis on Shakespeare and the Constitution.

The disadvantages of schools administering the achievement exams is that students have fewer chances to demonstrate their competence. If one has an off day, one must typically wait an entire year before the exam can be retaken (in Finland the delay is a few months and retaking the exam is very common). With employer administered exams, having an off day is less damaging for one will shortly have a chance to do better at another employer. Employers may also find it is easier to compare job applicants who have all taken the same employer administered exam.

For young workers, the two systems would probably have roughly equal validity. Scores are reported for each subject so employers may focus on the tests which have special relevance to their jobs. School administered tests are more reliable measures of achievement because they sample a much larger portion of the student's knowledge of the field (the ASVAB General Science subtest, by contrast, allows the student 11 minutes to do 24 items). They may also be more valid because they are not limited to the multiple choice format. Thus, even though the topics covered in the school exam are probably less relevant to the firm's jobs, it is probably just as valid a predictor of performance for young workers as a specially designed employment test.

Increasing numbers of employers need workers who are competent in mathematics, science, technology and communication. If these employers know who is well educated in these fields, they will provide the rewards needed to motivate study. Ninety-two percent of 10th graders say they "often think about what type of job I will be doing after I finish school"(LSAY, Q. AA13C). If the

labor market were to begin rewarding learning in school, high school students would respond by studying harder and local voters would be willing to pay higher taxes so as to have better local schools. The Secretary of Labor's Commission on Workforce Quality and Labor Market Efficiency advocates such a change:

> The business community should...show through their hiring and promotion decisions that academic achievements will be rewarded (p. 9).

> High-school students who excel in science and mathematics should be rewarded with business internships or grants for further study (p. 11).

Some might respond to this strategy for achieving excellence in our high schools by stating a preference for intrinsic over extrinsic motivation of learning. This, however, is a false dichotomy. Nowhere else in our society do we expect people to devote thousands of hours to a difficult task while receiving <u>only</u> intrinsic rewards. Public recognition of achievement and the symbolic and material rewards received by achievers are important generators of intrinsic motivation. They are, in fact, one of the central ways a culture symbolically transmits and promotes its values.[18]

Certifying Competencies

The Secretary of Labor's Commission on Workforce Quality recommended that:

> Schools should develop easily understood transcripts which at the request of students, are readily available to employers. These transcripts should contain documentable measures of achievement in a variety of fields as well as attendance records. State governments should provide assistance to facilitate the standardization of transcripts so that they will be more easily understood. (1989, p. 12)

Competency should be defined by an absolute standard in the way Scout merit badges are. Different types and levels of competency need to be certified.

One of the saddest consequences of the lack of signals of achievement in high school is that employers with good jobs offering training and job security are unwilling to take the risk of hiring a recent high school graduate. They prefer to hire workers with many years of work experience. One important reason for this policy is that the applicant's work record serves as a signal of competence and reliability that help the employer identify who is most qualified. In the US recent high school graduates have no such record and information on the student's high school performance is not available, so the entire graduating class appears to employers as one undifferentiated mass of unskilled and undisciplined workers. Their view of 18 year olds was expressed by a supervisor

at New York Life Insurance who commented on television "When kids come out of high school, they think the world owes them a living" *(PBS, March 27, 1989). Surely this generalization does not apply to every graduate, but the students who are disciplined and academically well prepared currently have no way of signaling this fact to employers.*

It is, therefore, desireable for the educational system to sponsor tests of competency and knowledge that are specific to the curriculum being studied (e.g. New York State's Regents Examinations, California's Golden State Exams, and NOCTI's Student Occupational Competency Achievement Tests) and then to provide students with diplomas and certificates certifying capabilities. State Departments of Education are logical sponsors of such a testing and certification program but they are not the only possible sponsor. Testing organizations (eg. the Educational Testing Service) or a new joint educator/employer organization could also sponsor and administer such a program. The National Commission on the Skills of the American Workforce (1990) recently provided a description of what a national system of performance measurement might look like:

The Foundation Skills

A new educational performance standard should be set for all students, to be net by age 16. This standard should be established nationally and benchmarked to the highest in the world.

All of our students should meet a national standard of educational excellence by age 16, or soon thereafter, which will equal or exceed the highest similar standard in the world for students of that age. A student passing a series of performance based assessments that incorporate the standard should be awarded a Certificate of Initial Mastery.

In order to adequately prepare our young people for working life, we must first see that they acquire the educational skills necessary to become effective players in a highly productive society. The establishment of a system of national standards and assessment would ensure that every student leaves compulsory school with a demonstrated ability to read, write, compute and perform at world-class levels in general school subjects (mathematics, physical and natural sciences, technology, history, geography, politics, economics and English). Students should also have exhibited a capacity to learn, think, work effectively alone and in groups and solve problems. Among other things, the Certificate of Initial Mastery would certify labor market readiness, and a mastery of the basic skills necessary for high productivity employment. The same Certificate would also be required for entry into all subsequent forms of education, including college preparatory and certified professional and technical programs.

The assessment system would establish objective standards for students and educators, motivate students and give employers an objective means to assess the

capabilities of job applicants. The Certificate of Initial Mastery would not indicate the completion of student's formal education. Rather, for the vast majority of students, this achievement would serve as a foundation for more advanced forms of education or training.

A Cumulative Assessment System

The assessment system should allow students to collect credentials over a period of years, perhaps beginning as early as entrance into the middle school. This kind of cumulative assessment has several advantages over a single series of examinations:

o   It would help to organize and motivate students over an extended period of time. Rather than preparing for a far-off examination (the form and demands of which a 12-year-old can only dimly imagine), students could begin early to collect specific certifications.

o   It would provide multiple opportunities for success rather than a single high-stake moment of possible failure. Cumulating certificates would greatly enhance the opportunity for the undereducated and unmotivated to achieve high educational standards. All could earn credentials at their own pace, as the criteria for any specific credential would not vary, regard less of the student's age.

o   It would allow students who are not performing well in the mainstream education system to earn their credentials under other institutional auspices.

An Independent Examining Organization

To set the assessment standards and certification procedures, we recommend the establishment of an independent national examining organization that broadly represents educators, employers and the citizenry at large. The organization should be authorized to convene working commissions in a variety of knowledge and skill areas to help train judges, set and assess standards and conduct examinations. The organization should be independent of schools and school systems and protected from political pressures (p 69-70).

Students should be given a competency profile certifying performance on each of these exams. State merit based scholarships should be awarded on the basis of these assessments and employers should be encouraged to factor examination results into their hiring decisions.

An exam system such as this maximizes incentives to study. All employers would have access to information on the academic achievements of job candidates, not just the employers who choose to give employment tests. The connection between effort in school, performance on the exams and job placement would become clearly visible to all. As such systems develop,

the Employment Service should modify its job referral system so as to incorporate the information on high school accomplishments generated by the system.

Credential Data Bank and Employee Locator Service

It may be unrealistic to expect 22,902 high schools to develop efficient systems of maintaining student records and responding quickly to requests for transcripts. An alternative approach would be to centralize the record keeping and dissemination function in a trusted third party organization. This organization would be easy to regulate and thus everyone could be assured that privacy mandates are being observed. The student would determine which competencies to have assessed and what types of information to include in his/her competency portfolio. Competency assessments would be offered for a variety of scientific, mathematical and technological subjects, languages, writing, business and economics and occupational skills. Tests with many alternate forms (or administered by computer based on a large test item bank) would be used so that students could retake the test a month later if desired. Only the highest score would remain in the system. Students would be encouraged to include descriptions of their extracurricular activities, their jobs and any other accomplishments they feel are relevant and to submit samples of their work such as a research paper, art work or pictures of a project made in metal shop. Files could be updated after leaving high school.

Students would have three different ways of transmitting their competency profile to potential employers. First, they would receive certified copies of their portfolio which they could carry to job interviews or mail to employers. Second, they would be able to call a 900 number and request that their portfolio be sent to specific employers. Thirdly, they could ask to put themselves in an employee locator data bank similar to the student locator services operated by the Educational Testing Service and American College Testing. A student seeking a summer or post graduation job would specify type of work sought and dates of availability. Employers seeking workers could ask for a print out of the portfolios of all the individuals living near a particular establishment who have expressed interest in that type of job and who pass the employer's competency screens. Student locator services have been heavily used by colleges seeking to recruit minority students and an employee locator service would almost certainly be used in the same way. This will significantly increase the rewards for hard study because the employee locator service is likely to result in a bidding war for the qualified minority students whose portfolios are in the system.

The National Alliance of Business, the American Business Conference, Educational Testing Service and California Department of Education are currently involved in developing systems like the one just described. Pilots are underway in Tampa Florida, Orange County California, Fort Worth Texas, and New Jersey. One wonders whether a federally sponsored credential data bank would have the credibility with business that is essential for success. The controversy over race-norming of VG-GATB illustrates the problems business might have with a government sponsored system. With respect to the credential data bank, probably the best role for the federal government is probably verbal support and limited financial support for a private initiative. Federal funding of the research and development necessary to develop the high quality assessments that might be used by this system would be desireable. A federally sponsored system of subject matter exams taken at the end of high school would speed the development of a credential data bank and would be desireable for other reasons. Current plans, however, envision constructing the credential data bank, state by state and city by city.

VI. RECOMMENDATIONS FOR IMMEDIATE ACTION

6.1 NEEDED IMPROVEMENTS IN OCCUPATIONAL COMPETENCY TESTING

The federal government has invested heavily in the development of a system of occupational competency assessment (OCA) for military jobs. It has invested almost nothing in developing occupational competency assessment instruments for civilian jobs. As a result, most occupational competency assessment instruments have been developed on a shoe string using predominantly volunteer labor. Where public authorities have been involved it has been at the state level and the result has been fragmentation of effort and incompatible standards which are barriers to geographic mobility. As the role of occupational competency assessment in program accountability and competency certification of trainees grows, it is important for the Department of Labor to shoulder responsibility for rationalizing and improving the system.

The most urgent need is to improve the security and up-to-dateness of occupational competency assessments. This would be accomplished by revising the OCAs on a regular basis and generating 3 or 4 alternative forms of an OCA when a revision is made. Consideration should be given to applying IRT technology to the development of OCAs for the more common occupations such as carpenter, auto mechanic and secretary. Consideration should also be given to developing modular tests. I propose that DOL consider funding the development of a set of more generic competency tests that would cover the skills that are common to an entire industry (eg construction or retailing) or occupational family (clerical work). The SCANS will hopefully provide DOL with a list of such competencies (Kane et al. 1990). These assessments should have a hands-on performance component. IRT testing technology should be used to develop these tests. This makes it easier to develop additional forms of the test and to drop items that become obsolete and add new items that reflect changes in skill needs and curriculum.

The Federal Role: When millions of copies of a test are being administered, the testing organization can be expected to foot the bill for test security and updating. Because of their specialized nature, however, most individual OCAs will probably be administered fewer than 5,000 times a year. To make the OCA available to as many as possible, fees should be set at marginal not average cost. If the cost of periodic revision of OCAs were included in the fee, the price charged would be too high. The information generated by these assessments has a public good character and, therefore, federal support of the development and updating costs is quite appropriate.

6.2 JOB REFERRALS BASED ON OCCUPATIONAL COMPETENCY ASSESSMENTS

Whenever possible the Employment Service (ES) should use occupational competency tests to refer job candidates to jobs listed at the ES. Many ES clients have expertise in an occupation for which validated occupational competency exams (eg. a NOCTI exam) are available. If there are (or are likely to be) job openings in the local labor market in this occupation, the client should be offered the opportunity to take the occupational competency exam as a way of signalling their level of competence to prospective employers. When an employer seeks a referral in this or a closely related occupation, he/she should be informed of the availability of a group of job applicants who have taken a validated competency test and asked if they wish to have all or some of these individuals referred. If only some of the clients for which competency tests are available are to be referred, referral selections should take years of work experience in the field and other indicators of competence as well as the competency tests into account. Giving priority to occupational competency tests not only maximizes the expected productivity of the individuals referred to a particular job; it also maximizes classification efficiency--the assignment of job seekers to jobs which make use of already acquired skills. If new hires will shortly be promoted into higher level jobs, the job knowledge test should also cover the skills required in these jobs.

Workers who score well on occupational competency exams are more productive on the job. When, however, a job can be learned very rapidly and at low cost, the gain from hiring on the basis of occupation specific skills may be small. If the skills are highly specific to the firm, it also may make little sense to look for already trained workers. In both cases qualities other than occupation specific skills such as dependability, sociability, adaptability, competence in reading and mathematics and ability to learn may be a more important consideration in hiring decisions. Consequently, occupation specific competency exams can never be the sole basis for an ES referral system. If the ES is to serve people who have no previous occupational training and experience or who desire to change occupations, a method needs to be developed for predicting the future job performance of individuals who currently have no training or experience in the field. Such a capability would help students select training programs more wisely and help workers find jobs in which they have a comparative advantage. Such a system would need to cover most jobs and be based on a set of reasonably stable measurable generic competencies which have different impacts in alternative occupations. It is to the design of such a system I now turn.

6.3 DEVELOPING AND VALIDATING A NEW GATB

VG-GATB is an effective system of referring job applicants to employers. Important efficiency gains are possible, however, from a modified VG-GATB referral system based on occupational competency assessments, ratings of work experience, other biodata and an expanded GATB. Developing this new referral system will require a major expansion of the Employment Services's program of test development and validity research. The research program would develop a new GATB based on IRT technology and increased use of constructed response questions whose cognitive component would resemble broad spectrum achievement test batteries such as the ASVAB.

I recommend that the NAEP adult literacy scales be substituted for the GATB's current vocabulary and mathematics tests. The NAEP Adult Literacy tests are a good choice because:

* They have high face validity. A public consensus exists that people should be able to do the tasks included on the test. It would be hard for someone to argue that it is silly to expect workers to be able to calculate change due a customer or read and understand prose. On the other hand, to a layman, the vocabulary words and the math problems included on the GATB appear to have no sensible connection with performing better in most jobs.

* The test advertises itself as measuring developed competency not aptitude. A job referral system based on achievement will be viewed as just by most of the public; one based on aptitudes or IQ will not be considered just.

* Document Literacy appears to be particularly relevant to a wide variety of jobs and is not available anywhere else.

* If the GATB becomes an important gatekeeper, you can bet that JTPA, JOBS, the Job Corps, adult literacy programs, high schools and community colleges will teach the competencies that are assessed by the test. Teaching materials designed to teach document literacy, the most innovative of the adult literacy concepts, will be available shortly from Apple Computer Corporation, ETS and Simon and Schuster. If people are going to spend time preparing to take this test, it is highly desireable that they be learning something that is indeed useful. This is a requirement which the adult literacy assessments fulfill better than other alternatives. When designing a job referral system that may come to serve a very large number of citizens, it is important to take into account it's impact on what and how teachers teach and students learn. The use of the adult literacy tests for job referrals would tend to cause many teachers to teach reading and mathematics using illustrations from real world activities. This should both reduce the problem of learning transfer and improve student motivation to learn.

* Because it uses a constructed response format, the adult literacy assessments are more authentic than alternatives and likely to be more reliable and valid as well.
* Since content validity is high, predictive validity is likely to be high as well.

* Four group administered alternative forms of this test have already been developed.

Since development of two of these versions was funded by the Department of Labor, there is no need to pay royalties. Since two versions of the test will be available to educators from Simon and Schuster, those who want to use adult literacy scores to assess the success of literacy programs will be able to do so without having to get permission from DOL. This use of IRT technology to develop three slightly different versions of the same instrument, two under government control and one in the hands of a private publishing concern, is a model of how DOL should make the results of future test development efforts available to the general public.

Before the Adult Literacy scales can be used in this way, however, it will be necessary to undertake a large study comparing the ability of the GATB verbal and mathematics tests and the literacy scales to predict job performance outcomes. Such a study should be undertaken right away.

Employment Service clients seeking typing or secretarial jobs would be expected to take the newly developed typing test. Those seeking jobs involving the use of a computer would be offered the opportunity to take a computer literacy test. Consideration should be given to using an updated version of the NAEP computer literacy scale for this purpose. By employing the latest computerized adaptive IRT testing technology, it will be possible to get reliable estimates of the individual's capability in a large number of domains, yet keep the test reasonably short.

Those intending to work in technical, craft or operative occupations would be encouraged to take a science test and/or a technology test. The easiest and quickest way to develop a technology test would be to simply construct additional forms of the ASVAB three technology subtests. If the military objected to this, it might be necessary to develop a new test from scratch. For science, there are a number of advantages to using tests tied to the same IRT scale as the NAEP science assessment:

* Using NAEP tests builds a stronger connection with the school curriculums in these subjects. Tests used in a job referral system may over time come to influence instruction in science, technology and computer courses, so it is desireable to consult with the educational system in developing these tests.

* NAEP tests are better at measuring higher order competencies and understanding of the scientific process than other science tests. NAEP is also trying to increase its use of constructed response items and simulations, a desireable trend.

* Science, technology and computers are rapidly changing fields so the tests will have to be updated quite frequently. The high costs of improving the measurement of higher order thinking skills, of introducing computerized adaptive testing and of frequently updating the test can be shared with the Department of Education. A better test is likely to result.

* There are potentially some important political advantages to using tests originally designed to assess the competence of students and which are overseen by a presidentially appointed board. The issue of what should be included in such a test is potentially controversial. Using the NAEP item pool to develop a parallel test may make it possible to avoid some of the potential controversy.

On the other hand, however, NAEP might be reluctant to let DOL use its science and computer assessment scale for job referral purposes. If schools were to start preparing students for exams based on the NAEP item pool, some would be concerned that the NAEP's ability to monitor trends in science literacy might be compromised. To deal with this concern, it would probably be necessary to increase the size of the NAEP item pool. If a national assessment of science competence not directly tied to NAEP (eg. the assessments proposed by Educate America or the Commission on the Skills of the American Workforce) were to become widely used, it would be desireable to use results from these assessments.

There is also a need for a NAEP style national assessment of business/economics literacy. As with the NAEP adult literacy scale, two forms of this assessment should be developed: a short test for NAEP style assessment employing matrix sampling and multiple forms of a longer test which can reliably assess individuals. Predictive validity studies should be conducted of the test in a variety of white collar occupations and if, as I suspect, it has substantial incremental validity, it should be introduced into the VG-GATB system.

6.4 PHASING OUT THE MULTIPLE CHOICE TEST

The Department of Labor should initiate the development of a set of constructed response tests and performance tests designed to replace or supplement the multiple choice tests currently used by DOL. Multiple choice tests lack authenticity. The problems encountered in life or at work do not have attached to them a handy list of four answers one of which is sure to be correct. This means that the effort spent preparing for multiple choice tests often results in a kind of learning that fails to transfer to real world situations. The second problem with multiple choice test is their sensitivity to guessing and the unreliability problems that this produces. This is a particularly serious problem when most test takers fail to complete the test and there is no subtraction made for wrong answers as in the current GATB. Under these circumstances, test takers who are advised to spend the last 30 seconds of the test guessing answers for the questions they have not completed will have a tremendous advantage over those who do not receive this advise. If everyone follows the guessing strategy, a serious problem remains for the guessing decreases the test's reliability and this in turn

necessitates a longer test (Sticht 1990). Thus, multiple choice tests reduce grading time by increasing the test taker time. The use of separate answer sheets causes still more problems. Having to place the answer in a bubble on a separate sheet is a potentially important source of error. Evidence that this is a problem comes from a number of studies which have found that students do better on tests when they put the answers in the test booklet rather than on a separate answer sheet.

Consequently, wherever feasible, new DOL sponsored paper and pencil tests should employ a constructed response format (where test takers figure out the answer and write it down) for some or all of the test. The multiple choice tests currently in use should be revised for administration using a constructed response format. It may be difficult to use a constructed response format in computerized adaptive tests, so an exception may need to be made here.

6.5 BIODATA

A biodata form similar to the one being developed by Office of Personnel Management focussing on measuring affective traits, specific skills, occupation specific work experience and accomplishments in school would also need to be developed. It is important that the questions asked be acceptable to Employment Service clients. This was also a concern of the Office of Personnel Management when it recently developed a biodata form for selection into the federal civil service. They developed the following guidelines for selecting questions to be included in a computerized biodata form.

(1)   Biodata should identify *events under the control of the job applicant*. Questions dealing with familial relationships such as child rearing practices, birth order, or relationships with parents and siblings would be precluded, for example, under this principle.

(2)   Biodata should be *judged relevant* (i.e., discernable to a knowledgeable person) to job performance. Questions dealing with property ownership or questions dealing with an individual's popularity would be precluded, for example, under this principle.

(3)   Biodata should *not likely be perceived as an invasion of an individual's personal privacy*. Questions dealing with personal habits, moral character, driving record (for a non-driving job), participation in political organizations, financial statues (e.g. tangible property owned, lines of credit, or insurance coverage), marital status, the work of one's spouse, time at present address, for example, would be precluded under this decision rule.

(4)   Biodata should *lend itself to independent verification*. This would preclude

inquiring into a person's attitudes, subjective choices, self-impressions, and opinions. Questions about job relevant knowledge, skills, and abilities, however, when asked from the perspective of how they would be evaluated by peers and former supervisors and teachers, would not be precluded.

(5)   Biodata should *not stereotype the individual on the basis of that person's race, color, religion, sex, or national origin.* This would preclude asking questions that serve as proxies for minority status or social class (Pace and Schoenfeldt, 1977); for example, distance from work, neighborhood, choice of public or private schools, or one's food preferences would probably be inappropriate under this principle.(pg. 6)

The biodata form should be designed with two purposes in mind: incremental validity in predicting job performance in contrasting occupations and generating rewards for hard study and exemplary behavior in school. For recent school leavers the biodata form should focus on accomplishments in school, courses taken including whether taken at an honors level, grades in specific courses and participation and leadership roles in specific extracurricular activities. Examples of the kinds of questions that might be included in a biodata form targeted at recent high school graduates are provided in Appendix D.

There should be two types of bio-data instruments. Everyone would fill out an instrument which covers accomplishments in school, total amounts of work experience, reasons for leaving recent jobs, preferred occupation and hours available for work. The second class of instruments would be specific to particular occupations. The JOBSCAN system being implemented in Ohio and Canada is an example of how occupational experience can be assessed using a forced choice questionnaire (see Appendix E for a list of the occupations for which JOBSCAN checklists have been developed and copies of some of the checklists). Individuals who have experience in more than one occupation would fill out more than one occupation specific instrument. The JOBSCAN instruments are a good start but they need to be expanded to ask for details on the training received at educational institutions. A contract should be let to develop a self-administered computerized bio-data forms.

6.6 INITIAL DESIGN OF THE EXPANDED VG-GATB SYSTEM

The design of the expanded VG-GATB system should not await new predictive validity research. Meta analyses of past studies, careful examination of the findings of Project A, content analysis and the professional judgements of industrial psychologists, economists, management consultants and employers can produce an initial design for the system. Content validity is a powerful tool that was under utilized in the design of the VG-GATB system. The

components of the system--the tests, competency assessments, a self administered computerized system of assessing occupational experience (derived possibly from JOBSCAN) and school accomplishments--would be obtained either be adopting an already existing instruments, modifying an existing instrument or developed from scratch by an outside contractor.

A blue ribbon advisory committee would advise the Employment Service and the Secretary of Labor regarding how these components should be integrated with each other. As soon as these decisions are made an outside contractor would be hired to work closely with the Employment Service to develop explanatory materials, computer software and training manuals and to provide training for local office staff. As soon as the training materials are ready, the new system would then be implemented in as many states as are interested. Contracts would be let to outside organizations to evaluate the experience with the new system in the sites where it is first implemented.

ES referral policies should not be frozen while the new system is being developed and introduced. It makes no sense at all to stop pilot site use of VG-GATB on the grounds that more research is needed. This stops the refinement and learning process that is under way at these sites and makes it harder to recruit employers to participate in ES validation research. Much has already been learned from VG-GATB's pilot phase. We learned, for example, that employers wanted the Employment Service to continue to take specific skills and work experience into account when making referrals. Much more can be learned by studying the cumulating experience with VG-GATB. If this decision is not reversed, much less information about VG-GATB's effects will be available to decision makers two years from now.

Experience in operating the system will in fact be one of the primary teachers. As findings accumulate ad hoc modifications would be made to the modified VG-GATB system described in the next section. The research program would be a continuous process of refinement, updating and improvement. The military's 50 year research program on the ASVAB is a possible model of how the Employment Service can periodically revise an ongoing selection and classification system.

6.7 PREDICTIVE VALIDITY STUDIES TO REFINE THE NEW SYSTEM

The second element of the research program involves predictive validity studies of the newly developed instruments and the revised VG-GATB system. This research should be conducted simultaneously with the implementation of the new system. The objective would be to collect validity data on 300 workers in 100 different occupations each year for at least the next ten years. Criterion data should be expanded to include wage rates, absenteeism,

turnover intentions, employee suggestions for increasing sales or improving productivity and ratings of the employee's ability to work effectively as part of a team and the employees sucess in relating to customers and suppliers.

Prospective validity studies would be needed to refine and empirically validate instruments measuring domain specific knowledge (eg. electronics, auto mechanics). Prospective validity studies are necessary because working in an occupation increases the worker's job knowledge. A job knowledge test can be empirically validated for selection purposes only by correlating occupational competency assessments administered prior to starting to work at a firm with subsequent performance in the job. Prospective studies would also make possible an expansion of the criterion domain. Models should be estimated predicting quit rates, dismissal rates, promotion outcomes as well as performance ratings. Such models would allow us to study the effects of the selective nature of turnover on estimates of the true relationship between worker competencies at time of hiring and subsequent job performance.

The USES has demonstrated that it can conduct high quality validity research at remarkably low cost. The research budget is currently so small (only about 5 million dollars), however, that a large proportionate increase will be necessary. This does not create administrative problems, however, because the same basic research design would be replicated in many different occupations and much of the money would be transferred to the states to be spent on data collection. A substantial increase in ES research staff will be required, however, if the target of studying 100 occupations per year is to be met. I recommend that the agency be immediately authorized to hire 20 additional PhD industrial psychologists (10 new PhDs and 10 IPAs with at least 6 years of professional experience). The primary constraint on the scale of this research effort is research sites not ES research staff. Workers and supervisors must be paid while they are filling out questionnaires and taking tests, and these costs sometimes make it difficult to recruit employers to participate. To facilitate ES access, employer organizations should be asked to co-sponsor the studies.

6.8 THE FEDERAL ROLE

The traditional role of government in the development of employment testing has bee in funding and directing research and development. The primary application of the knowledge generated by this R&D program has been to the selection, assignment and training of the armed forces. There is probably no large organization in the world where testing has become

such a pervasive part of recruitment, selection, training and management. The sophisticated use of competency and aptitude testing by the US military is one of the reasons why it has performed so effectively in the Persian Gulf. The second objective of R&D in this area has been the development of improved ES referral systems. This civilian research program has been drastically under funded, however.

Fear of litigation has significantly inhibited testing research outside of government. Companies no longer share the results of their validity studies or allow them to be published (even when the company's name is withheld) for fear of revealing their defense strategy to a potential litigant. As a result, research on alternatives to the GATB and the ASVAB has been inhibited. The government must step into the vacuum it has created and sponsor a major increase in research into the development and validation of improved employment tests. The results of the research should be published and versions of the instruments developed should be made available through private publishers. The protocols and computer programs used in implementing the Expanded VG-GATB system should be available for license.

6.9 IS TOP DOWN REFERRAL SOCIALLY OPTIMAL?

The Employment Service has multiple constituencies: different types of job applicants, employers and the voting public. How is it to balance the interests of its various constituencies? The employment service has always been in the situation of having fewer employer requests for referrals than clients seeking jobs. During the 1950s and early 1960s, it took the position that it could best serve job seekers as a whole by sending employers the best possible applicants.

> *The standard practice up to [the mid 1960s] had been for a personnel representative in a firm to call a local office staff member with whom they had worked in the past, place a job order, and be confident that the local office staff person would only refer individuals in accordance with the employer's hiring requirements (Stevens 1988, p. 30).*

During this period ES referrals accounted for nearly 20 percent of the nation's new hires. Priorities shifted in the mid 1960s and the ES "became one of the Nation's public advocacy weapons for affirmative action on behalf of targeted populations":

> *In the mid-1960s local office procedures were modified in several ways. First, discriminatory referral procedures, which had always been frowned upon, were now more actively discouraged. And second, individual staff member control of job orders began to decline, which meant that the one-on-one relationships between employer representatives and State Employment Security Agency staff members were weakened. Both of these challenged the ability of the local office to offer a continuing guarantee of screening reliability. Many observers attribute the growth of private employment*

> agencies coincident with the stagnation of the public employment service system to
> this social responsibility of the public agencies (Stevens, 1988, p. 30).

Funding formulas were skewed to emphasize placement of targeted groups rather than total placements. The Employment Service's market share fell precipitously to about 8 percent of new hires in 1971. It remained low throughout the 70s and 80s and in 1987 was about 7 percent (Cohen and Stevens, 1989). The result is that in 1987/88 it placed only 17.5 percent of the 18,439,000 people who requested help in seeking work. In addition, the quality of the positions for which it obtained job orders deteriorated.

> For a labor market intermediary to succeed:

> Employers must have confidence in the ability and willingness of the labor exchange
> broker to conduct the appropriate screening function, and the job seeker must also
> have confidence that they will be made aware of appropriate opportunities through
> the broker's auspices (Stevens 1988, p. 31).

By 1983 the reputation of the ES had deteriorated to such an extent that most employers did not want to receive referrals of workers eligible for TJTC tax credits worth nearly 50 percent of the wage if the referral was to be made by the employment service (Bishop 1987). The employment service lost much of its middle class constituency and was, consequently, unable to fend off substantial budget cuts during the most severe recession since World War II. The very high priority placed on serving one particular constituency resulted over time in the agency losing the support of other constituencies: employers, voters, and nondisadvantaged workers. Since they control the scarcest element of the job matching process, job openings, employer disillusionment was particularly damaging. The agency even began to lose its ability to serve the disadvantaged.

VG-GATB and, in particular, office wide implementation of VG-GATB represents an effort to remake the reputation of the Employment Service and to return at least part way to the philosophy that prevailed in the 1950s and early 1960s--that of honest broker. This, I feel, should be the primary goal and role of a job matching service. In the computer age, there are substantial economies of scale in the labor exchange function. The Employment Service should aggressively seek to improve the matching of workers to jobs in our economy. Achieving this goal will require that the ES greatly expand the number of employers for which it provides referral services.

What should office wide implementation of an expanded VG-GATB system look like? With only a few exceptions, all ES registrants should complete the general and occupation specific biodata instruments. This information would be entered into a computer either directly by the applicant or through an optical scanning instrument. The applicant would also

specify the types of jobs he/she would like to be referred to and provide (on a confidential basis) his/her minimum acceptable wage. Information on the minimum acceptance wage would never be released to an employer. Individuals wanting to compete on the basis of a typing test or an occupational competency test would take the appropriate test and referrals would be based on some combination of biodata and test results. Otherwise, the individual would be encouraged (but not required) to take the expanded VG-GATB battery and referrals would be based on some combination of biodata and GATB subtest scores. Individuals who choose neither of the test based options would be referred on the basis of biodata alone. Employers seeking referrals would specify which of the three types of screening they prefer. Employers requesting screening on the basis of occupational competency tests would have first crack at the pool of applicants. Employers desiring screening on the basis of occupationally specific skills, training and experience (either solely or in combination with GATB test scores) would have second crack. Employers not seeking occupation specific skills would have third crack at the pool. Within these categories, firms offering the higher compensation during the first few years on the job would be serviced first.

The purpose of this system of priorities is to try to insure that workers who are highly skilled in a particular occupation are able to stay in that occupation and are not referred to jobs which do not make use of these skills. It is also intended to result in the higher wage firms being able to attract the more qualified workers. It is not likely to be completely successful, however. Since the stock of applicants will be much larger than the flow of job orders, the system will have a tendency to allocate opportunities to search the applicant pool on a first-come-first-serve basis. Employers, even low wage employers, would have referred to them the most qualified applicants in the system at the time they enter their job order. It is not clear that this is the optimal sorting/referral algorithm. It may be desireable for applicants who are highly qualified in a particular field to limit their search for a while to jobs which make full use of their skills and then broaden the search to lower paying jobs which make lesser use their skills only when the first effort is clearly not yielding fruit. If the screening/referral algorithm is rerun every week rather than every day, the priority system would have more effect but this would significantly delay response to job orders. Probably a better approach would be to encourage applicants to specify a minimum acceptable wage which declines as time passes.

Referring high skilled workers to low skill jobs may be counterproductive. Before an individual is referred, the ES should have good reason to believe that the applicant will

probably accept the job if offered and not quit as soon as something better comes along. Probability of turnover, is thus another factor that needs to be considered when making referral decisions. Some careful thought needs to be given to these issues and I recommend that the ES fund studies of the turnover of ES referrals and more than one simulation study of the consequences of different sorting/referral algorithms. While the high-skill-high-wage firms in a community should clearly receive top-down referral service from the ES, it is not self evident that low-skill-high-turnover firms should have essentially equal priority to top-down referrals based on GATB test scores (constrained only by job seeker reservation wages and occupation preferences).

The danger that many see in a fully implemented VG-GATB system is that all employers will choose to receive top-down referrals and ask that their job opening not be revealed to other registrants. The workers with high GATB scores will be quickly snapped up, and those with low test scores will languish indefinitely in the pool of registrants not even receiving referrals to low skill low wage jobs. As additional job orders flow into the ES, the reservoir of high test score individuals would probably become depleted. Employer disillusionment with the ES might return, shutting off the growth of job orders before a reasonable balance has been achieved between the flow of applicants and the flow of job orders. The new equilibrium market share would be higher than it is now, but the ES would no longer be providing referral assistance to the low-skill low-test-score job seekers. These individuals would have to make their own job contacts. Job club type assistance might be about all that the ES could do for these individuals.

If the ES is to maximize its market share and to serve its multiple constituencies, it must somehow forestall this outcome. The best way to deal with this problem is to charge employers who receive referrals on the basis of competency or GATB tests a fee of about $15.00 per referral to cover the costs of the testing. Non-test based referrals and "cast a wider net" referrals would remain free. The fee would be set at a level designed to insure that at least 25 percent of the job orders received would not specify test based referral. The advantage of this approach is that it internalizes an externality generated by the common property character of being able to make top-down selections from the ES's applicant pool. The situation is something like that of an over exploited fishery. The only alternative I see to differential fees, is the exclusion of certain categories of jobs from access to the top-down referral pool. I prefer the fee system because the decision about whether to access the top-down referral pool is left to the firm not to bureaucratic judgement or regulations.

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ENDNOTES

1. These tests are being used within the state and will be made available to vocational educators in other states when norms are available. For more information write to the Oklahoma Occupational Testing Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074.

2. Since most teachers prefer to teach intelligent, well-behaved, motivated students, there will always be pressure to cream -- that is, to recruit the most able and screen out those with learning or attitude problems. Program and teacher reputations tend to be more influenced by absolute levels of student achievement -- cars repaired, houses well constructed, and good jobs obtained--than by value added -- saving individuals who were headed for failure.

3. Studies that measure output for different workers in the same job at the same firm, using physical output as a criterion, can be manipulated to produce estimates of the standard deviation of non-transitory output variation across individuals. It averages about .14 in operative jobs, .28 in craft jobs, .34 in technician jobs, .164 in routine clerical jobs and .278 in clerical jobs with decision making responsibilities (Hunter, Schmidt & Judiesch 1988). Because there are fixed costs to employing an individual (facilities, equipment, light, heat and overhead functions such as hiring and payrolling), the coefficient of variation of marginal products of individuals is assumed to be 1.5 times the coefficient of variation of productivity. Because about 2/3rds of clerical jobs can be classified as routine, the coefficient of variation of marginal productivity for clerical jobs is 30 % [1.5*(.33*.278+.67*.164)]. Averaging operative jobs in with craft and technical jobs produces a similar 30% figure for blue collar jobs. The details and rationale of these calculations are explained in section 3.2, Bishop 1988b and in Appendix B.

4. The formula was $SD(R^m_j) = (R^m_{ij}-R^m_j)^2/N-1$. Occasionally employers who had only 2 or 3 employees gave them all the same rating. Consequently, a lower bound of 40 percent of the mean $SD(R^m_j)$ was placed on the value the SD could take. Models were also estimated which did not standardize job performance variance across firms and which instead standardized the variances only across the occupation. None of the substantive findings were changed by this alternative methodology.

5. This estimate of the variance ratio is probably too large for two reasons. First, selective turnover has been operating for only a year. Second, workers who were promoted to better jobs were retained in the calculation not dropped. If a longer period were analyzed and workers had been dropped from the sample when they were promoted, a lower variance ratio would have been obtained and all estimates of sorting effects would have increased proportionately. On the other hand, large establishments were under represented in the study. Since they tend to have less selective turnover than small establishments, this produces a small bias in the opposite direction.

6. Large as it may seem the estimate for operators of nuclear plants is in fact quite reasonable. In the first 4000 years of world wide operation of nuclear plants there have been two catastrophic accidents caused by operator error each costing over 5 billion dollars. The NRC estimates that improved safety procedures will reduce operator caused catastrophic accidents to about one fifth that rate (one in every 10000 years of plant operation). There are about 5 six person shifts operating each plant, so the standard deviation of output across individual workers that results from just this one risk is about $9 million per year.

7. This hierarchical process for allocating new hires to jobs is not fully optimal. Some workers will not be assigned to the occupation in which they have the greatest comparative advantage. A computer program that assigns all new hires optimally would be much more complex and the task has been left for another paper.

8. If the SD$ for retail clerks had been calculated by multiplying the CV by 1.52 as for other occupations, sales clerks would have been placed above operatives and service workers in the hierarchy and these two occupations not sales clerks would have been assigned the lowest scoring students. This would significantly reduce the productivity decline among sales clerks but produce a substantial decline in the productivity of service workers and increase the decline in the productivity of operatives. The total change in productivity for the economy as a whole from resorting would not be very different, however.

10. A substantial number of employers believe minority job applicants are likely to be less productive. Acting on such beliefs is unlawful, but it would be naive to assume that the subjective assessments that generally determine hiring decisions are not affected by such beliefs. Economists have shown that when there are no laws to the contrary, it is rational for a firm to engage in statistical discrimination--ie. to include race and gender as one of their selection criterions if these traits help explain job performance when other qualifications (e.g. education and work experience) are held constant. How will an employer that evaluates job applicants using the statistical discrimination model respond to being allowed for the first time to use employment tests as a selection criterion? The employer will recalculate the job performance prediction model with the new academic achievement variables included and selections will be based on the new model. THe average predicted job performance of minority job candidates will not change for the tendency of achievement deficits to lower the predicted job performance of minority candidates will be exactly offset by a reduction in the negative coefficient on the black and Hispanic dummy variables. The new information increases the variance explained by the job performance model and half of the minority job applicants will have higher predicted productivity than before the test information became available. If in the no testing environment, the firm hires a third or more of its nonminority job applicants but only a tiny share of its minority job applicants, the use of tests will result in a rise in minority representation at the firm (Aigner and Cain 1978).

11. The calculations of the effect of optimal sorting on wage rates assume (1) that all of the gain in aggregate productivity is captured by workers in the form of higher wages or lower prices for consumption items, (2) that relative wages across occupations remain unchanged and (3) that resorting does not cause within occupation wage differentials by gender and ethnicity to change. Changes in assumptions would, of course, modify the results. If resorting on the basis of test scores were to increase the relative wage of craft and technical jobs and reduce the wage of operative and sales clerk jobs, resorting would tend to have a more negative effect on the wages of minority workers. For example, a $1000 decrease in operative and sales clerk wages combined with an offsetting increase of $1210 in the top three occupations would after resorting lower the average wage of blacks by 2.8 percent and Hispanic by 1.4 percent. If the use of test to select workers also resulted in resorting of

workers within occupation, both the aggregate productivity gain from resorting and the reduction in the relative wage of minority workers would remain positive. If the operative occupation had been placed at the bottom of the hierarchy, the decline in the relative wage of minority workers would be much smaller and might have been erased. If the service occupation had been assigned a lower rank than operatives, the relative wage decline for minority workers would have been larger.

12. The result is that when supervisors are asked for job performance ratings, the mean for Black workers in the GATB revalidation data and other studies is --- below the mean for white workers doing the same job at the same firm and Hispanic workers are rated --- below the Anglo mean for that job.

13. A survey of a stratified sample of the membership of the National Federation of Independent Business found that in 1987 only 3 percent of small and medium sized firms were using aptitude test data to help make hiring decisions.

14. To meet the concerns of the Department of Justice, one might amend it by allowing employers to request in writing that they not be sent referrals based on within-group scoring. The ES would encourage employers to choose the Combined Rules Referral Plan. The Employment Service would take no position on the issue of whether refusing to accept the within group scored referrals raises a Title VII liability. I predict that almost all employers will choose the first option regardless of the outcome of the current Congressional efforts to repeal the Supreme Court's Wards Cove decision.

15. This adverse impact results not because tests are unfair but because academic achievement contributes to worker productivity and because there are, unfortunately, real differences in mean levels of academic achievement between groups (Jones 1988). The tests are giving us the unhappy news that educational opportunities and achievement have not been equalized. The cause of the situation is the low quality of the education received by most Blacks and Hispanics. Progress has been made in reducing these quality differentials and achievement gaps are diminishing. This means the problem will diminish over time. If the process of closing the gap is to be speeded there needs to be increased investment in both regular and adult basic education.

16. Most of the published studies of the validity of grades probably used information that had been collected by the firm when hiring decisions were being made. Consequently, most of the validity coefficients reported for grades are probably negatively biased by the selection effects so the true validity of GPA than is generally thought.

17. Mueser and Maloney (1987) develop a model of job tryout hiring which they claim implies that it may be efficient to ignore available information on stable worker competencies signaled by high test scores. They apparently do not recognize that the model also implies that information on education and previous work experience should also be ignored. They acknowledge that "Although employing applicants for long enough to observe performance entails costs of training and lost productivity, it may increase the incentives workers have to apply effort to learning their jobs by enough to compensate for such costs." In fact, however, turnover costs are so large--training costs are generally about one month's wages and fired workers suffer a couple of months of unemployment--, that a sequential decision

that information on education and previous work experience should also be ignored. They acknowledge that "Although employing applicants for long enough to observe performance entails costs of training and lost productivity, it may increase the incentives workers have to apply effort to learning their jobs by enough to compensate for such costs." In fact, however, turnover costs are so large--training costs are generally about one month's wages and fired workers suffer a couple of months of unemployment--, that a sequential decision strategy will always dominate the strategy they consider. It will hardly ever be optimal to hire ten people for one position and then fire 9 of them after a tryout. In any job requiring even a modest amount of specific training or transitional unemployment, the optimal strategy is to use all the inexpensive information available to make an initial selection and then to give those selected a tryout but to plan on seldom having to fire the new employee. It is true, however, that the option of firing the worst performers results in Brogden's formula overstating the private benefits of a selection method.

18.   Another possible argument against policies designed to induce employers to reward high school students who study is that poor students will not be considered if an employer learns of this fact. What those who make this argument do not realize is that the policy of providing no information to employers about performance in high school results in no recent graduates (whether good or poor student) getting a job that pays well and offers opportunities for training and promotions. In effect it is being proposed that the interests of the students who do not study and are discipline problems should take precedence over the interests of the students who lived by the schools rules and studied hard. There is nothing unfair about letting high school GPA's influence the allocation of young people to the best jobs. The grade point average reflects performance on hundreds of tests, and the evaluations of over 20 teachers each of which is based on over 180 days of interaction. Selection decisions must be made somehow. If measures of performance in school are not available, the hiring selection will be determined by the chemistry of a job interview and idiosyncratic recommendations of a single previous employer. Since many employers will not request the information, providing information on student performance does not prevent the poorer student from getting a job; it only influences the quality of the job that the student is able to get.

Appendix A.

Purposes

The ASVAB is a multiple aptitude battery designed for use with students in Grades 11 and 12 and in postsecondary schools. The test was developed to yield results that are useful to both schools and the military. Schools use ASVAB test results to provide educational and career counseling for students. The military services use the results to identify students who potentially qualify for entry into the military and for assignment to military occupational training programs.

Like other multiple aptitude batteries, the ASVAB measures developed abilities and predicts what a person could accomplish with training or further education. This test is designed especially to measure potential for occupations that require formal courses of instruction or on-the-job training. In addition, it provides measures of general learning ability that are useful for predicting performance in academic areas.

The ASVAB can be used for both military and civilian career counseling. Scores from this test are valid predictors of success in training programs for enlisted military occupations. Through the use of validity generalization techniques, predictions from military validity studies can be generalized to occupations that span most of the civilian occupational spectrum. Although some enlisted occupations are military specific, more than 80% of these occupations have direct civilian occupational counterparts.

Since the ASVAB was first used in high schools in 1968, it has been the subject of extensive research and has been updated periodically. Appendix A contains a brief history of the ASVAB and the various forms that have been used.

Key Features

ASVAB-14, introduced in the 1984–85 school year, contains several key features that were not included in previous forms. These key features include

- **Improved usefulness in measuring vocational aptitudes:** In addition to yielding *academic composites* that provide measures of academic potential, ASVAB-14 supplies *occupational composites* that provide measures of potential for successful performance in four general career areas.

- **increased reliability:** Changes in the length and number of subtests have increased the test's reliability without a substantial increase in testing time.

- **nationally representative norms:** ASVAB-14 is normed on a nationally representative sample of 12,000 women and men, ages 16-23, who took the test in 1980.

Content

Subtests

GENERAL SCIENCE
11 Minutes
25 Items
Description
Measures knowledge of the physical and biological sciences.

ARITHMETIC REASONING
36 Minutes
30 Items
Description
Measures ability to solve arithmetic word problems.

Figure 1-1.
ASVAB-14
CONTENT.
Testing Time .... 144 minutes
Administrative Time .... 36 minutes
Total Testing Time .... 180 minutes
Total Number
of Items 334

WORD KNOWLEDGE
11 Minutes
35 Items
Description
Measures ability to select the correct meaning of words presented in context and to identify the best synonym for a given word.

PARAGRAPH COMPREHENSION
13 Minutes
15 Items
Description
Measures ability to obtain information from written passages.

NUMERICAL OPERATIONS
3 Minutes
50 Items
Description
Measures ability to perform arithmetic computations in a speeded context.

CODING SPEED
7 Minutes
84 Items
Description
Measures ability to use a key in assigning code numbers to words in a speeded context.

AUTO & SHOP INFORMATION
11 Minutes
25 Items
Description
Measures knowledge of automobiles, tools, and shop terminology and practices.

MATHEMATICS KNOWLEDGE
24 Minutes
25 Items
Description
Measures knowledge of high school mathematics principles.

MECHANICAL COMPREHENSION
19 Minutes
25 Items
Description
Measures knowledge of mechanical and physical principles and ability to visualize how illustrated objects work.

ELECTRONICS INFORMATION
9 Minutes
20 Items
Description
Measures knowledge of electricity and electronics.

B. Sample Test Items

General Science

1. An eclipse of the sun throws the shadow of the

   1-A moon on the sun.
   1-B moon on the earth.
   1-C earth on the sun.
   1-D earth on the moon.

2. Substances which hasten chemical reaction time without themselves undergoing change are called

   2-A buffers.
   2-B colloids.
   2-C reducers.
   2-D catalysts.

Arithmetic Reasoning

3. How many 36-passenger busses will it take to carry 144 people?

   3-A 3
   3-B 4
   3-C 5
   3-D 6

4. It costs $0.50 per square yard to waterproof canvas. What will it cost to waterproof a canvas truck cover that is 15' x 24'?

   4-A $ 6.67
   4-B $ 18.00
   4-C $ 20.00
   4-D $180.00

Word Knowledge

5. The wind is variable today.

   5-A mild
   5-B steady
   5-C shifting

6. Rudiments most nearly means

   6-A politics.
   6-B minute details.
   6-C promotion opportunities.

Paragraph Comprehension

7. Twenty-five percent of all household burglaries can be attributed to unlocked windows or doors. Crime is the result of opportunity plus desire. To prevent crime, it is each individual's responsibility to

   7-A provide the desire.
   7-B provide the opportunity.
   7-C prevent the desire.
   7-D prevent the opportunity.

8. In certain areas water is so scarce that every attempt is made to conserve it. For instance, on one oasis in the Sahara Desert the amount of water necessary for each date palm tree has been carefully determined.

   How much water is each tree given?

   8-A no water at all
   8-B water on alternate days
   8-C exactly the amount required
   8-D water only if it is healthy

Numerical Operations

9. $3 + 9 =$

   9-A 3
   9-B 6
   9-C 12
   9-D 13

10. $60 \div 15 =$

    10-A 3
    10-B 4
    10-C 5
    10-D 6

Coding Speed

KEY

bargain 8385	house..........2859	owner..........6227
chin 8930	knife...........7150	point 4703
game 6456	music..........1117	sofa 9645
	sunshine 7489	

QUESTIONS	A	B	C	D	E
11. game	6456	7150	8385	8930	9645
12. knife	1117	6456	7150	7489	8385
13. bargain	2859	6227	7489	8385	9645
14. chin	2859	4703	8385	8930	9645
15. house	1117	2859	6227	7150	7489
16. sofa	7150	7489	8385	8930	9645
17. owner	4703	6227	6456	7150	8930
	A	B	C	D	E
18. music	1117	2859	7489	8385	9645
19. knife	6227	6456	7150	7489	8485
20. sunshine	4703	6227	6456	7489	8930
21. chin	1117	2859	4703	7150	8930

Auto & Shop Information

25. A car uses too much oil when which parts are worn?

   25-A pistons
   25-B piston rings
   25-C main bearings
   25-D connecting rods
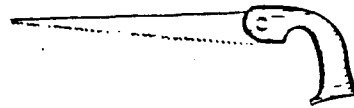
26. The saw shown above is used mainly to cut

   26-A plywood.
   26-B odd-shaped holes in wood.
   26-C along the grain of the wood.
   26-D across the grain of the wood.

Mathematics Knowledge

27. If x + 6 = 7, then x is equal to

   27-A 0
   27-B 1
   27-C -1
   27-D 7/6

5 FT.
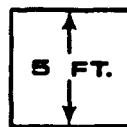
28. What is the area of this square?

   28-A 1 square foot
   28-B 5 square feet
   28-C 10 square feet
   28-D 25 square feet

Mechanical Comprehension
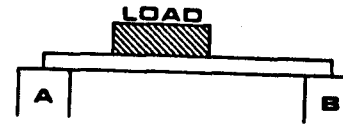
LOAD

29. Which post holds up the greater part of the load?

   29-A post A
   29-B post B
   29-C both equal
   20-D not clear
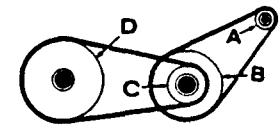
30. In this arrangement of pulleys, which pulley turns fastest?

   30-A A
   30-B B
   30-C C
   30-D D

Electronics Information

31. Which of the following has the least resistance?

   31-A wood
   31-B iron
   31-C rubber
   31-D silver
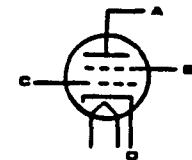
32. In the schematic vacuum tube illustrated, the cathode is element

   32-A A
   32-B B
   32-C C
   32-D D

Key To The
Sample Test Items

1.	B	17.	B
2.	D	18.	A
3.	B	19.	C
4.	C	20.	D
5.	C	21.	E
6.	D	22.	E
7.	D	23.	C
8.	C	24.	B
9.	C	25.	B
10.	B	26.	B
11.	A	27.	B
12.	C	28.	D
13.	D	29.	A
14.	D	30.	A

NAME OF WORKER (Print)   (Last)   (First)

SEX: MALE_____   FEMALE_____

Company Job Title: _____

How often do you see this worker in a work situation?	How long have you worked with this worker?
☐ All the time.	☐ Under one month.
☐ Several times a day.	☐ One to two months.
☐ Several times a week.	☐ Three to five months.
☐ Seldom.	☐ Six months or more.

A.   How much can this worker get done? (Worker's ability to make efficient use of time and to work at high speed.) (If it is possible to rate only the quantity of work which a person can do on this job as adequate or inadequate, use #2 to indicate "inadequate" and #4 to indicate "adequate.")

☐   1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐   2. Capable of low work output. Can perform at a slow pace.

☐   3. Capable of fair work output. Can perform at an acceptable pace.

☐   4. Capable of high work output. Can perform at a fast pace.

☐   5. Capable of very high work output. Can perform at an unusually fast pace.

B.   How good is the quality of work? (Worker's ability to do high-grade work which meets quality standards.)

☐   1. Performance is inferior and almost never meets minimum quality standards.

☐   2. Performance is usually acceptable but somewhat inferior in quality.

☐   3. Performance is acceptable but usually not superior in quality.

☐   4. Performance is usually superior in quality.

☐   5. Performance is almost always of the highest quality.

C.   How accurate is the work? (Worker's ability to avoid making mistakes.)

☐   1. Makes very many mistakes. Work needs constant checking.

☐   2. Makes frequent mistakes. Work needs more checking than is desirable.

☐   3. Makes mistakes occasionally. Work needs only normal checking.

☐   4. Makes few mistakes. Work seldom needs checking.

☐   5. Rarely makes a mistake. Work almost never needs checking.

D. How much does the worker know about the job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with the work.)

☐ 1. Has very limited knowledge. Does not know enough to do the job adequately.

☐ 2. Has little knowledge. Knows enough to get by.

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows the job thoroughly.

E. How large a variety of job duties can the worker perform efficiently? (Worker's ability to handle several different operations.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

F. Considering all the factors already rated, and only these factors, how good is this worker? (Worker's all-around ability to do the job.)

☐ 1. Performance usually not acceptable.

☐ 2. Performance somewhat inferior.

☐ 3. A fairly proficient worker.

☐ 4. Performance usually superior.

☐ 5. An unusually competent worker.

Complete the following ONLY if the worker is no longer on the job.

G. What do you think is the reason this person left the job? (It is not necessary to show the official reason if you feel that there is another reason, as this form will not be shown to anybody in the company.)

☐ 1. Fired because of inability to do the job.

☐ 2. Quit, and I feel that it was because of difficulty doing the job.

☐ 3. Fired or laid off for reasons other than ability to do the job (i.e., absenteeism, reduction in force).

☐ 4. Quit, and I feel the reason for quitting was not related to ability to do the job.

☐ 5. Quit or was promoted or reassigned because the worker had learned the job well and wanted to advance.

RATED BY	TITLE	DATE
COMPANY OR ORGANIZATION	LOCATION (City, State, ZIP Code)	

APPENDIX C

STUDIES OF OUTPUT VARIABILITY

A search for studies of output variability yielded 49 published and 8 unpublished papers covering 94 distinct jobs.[6] Their results are reported in tables 1 through 4. Table 1 summarizes the studies of output variability among semiskilled factory workers. The jobs known to be paid on a piece rate basis are not included in the table. Schmidt and Hunter (1983) found that such jobs typically have smaller coefficients of variation. Apparently when workers are paid on a piece rate basis, quit rates are more responsive to productivity than when pay is on an hourly basis. The less productive workers self select themselves out of such jobs and the surviving job incumbents become more and more similar in their output.

Estimates of productivity standard deviations (SD$) in 1985 dollars are reported in column 2 of the tables. In most cases the author of the study made no attempt to estimate SD$'s, so the estimate has been calculated from the CV. Such estimates are placed in a parenthesis. The estimates of SD$ were derived as a product of the CV, the mean compensation for that job and the ratio of value added to compensation for that industry. This ratio is 1.52 for private non-farm business excluding mining, trade, finance and real estate. The value added to compensation ratio in retailing and in real estate was much too high to be used as an adjustment factor. So for all sales occupations it was assumed that SD$ = CV times average compensation. The SD$ of semiskilled factory jobs ranged from $1732 to $7811 and averaged $5062 for jobs not known to be paid on a piece rate.

Table 2 reports managerial estimates of coefficients of variation and productivity SD$'s for plant operators and a number of craft occupations. For craft occupations other than plant operators, the average CV is 27.6 percent and the average SD$ is $12,399. These are smaller than for plant operators and larger than those for semi-skilled factory workers. Within the ranks of blue collar workers there is a clear tendency for coefficients of variation and standard deviations of output to rise with the complexity and wage rate of the job.

Output variability is also great in professional and high level managerial occupations. Users of communication satellites, for example, are going to save billions of dollars as a result of a discovery by a scientist at Comsat which has doubled the effective lifetime of satellites.

Exxon had invested a billion dollars in its shale oil operation at Parachute
Creek before giving up on the enterprise. A wiser CEO or better staff work
might have avoided or reduced this loss. It does not take many such examples
to produce a very large standard deviation of output for professional and
high level managerial jobs. In most white collar jobs, however, output
variability across incumbents is much smaller.

Table 3 reports the results of studies of output variability in clerical
occupations. In many of these studies hard measures of output (e.g., cards
punched) were the basis for calculating coefficients of variation.

Table 4 contains estimates of CVs and standard deviations of output
for the remainder of the occupational distribution: managerial, technical,
sales service personnel. For sales personnel the CVs are based on hard data,
distributions of actual sales. The variability of output in sales occupations
is clearly higher than in most other occupations and the variability appears
to rise with the complexity of the product that is being sold and the amount
of initiative required to sell large amounts of the product. For high level
sales personnel working in finance and manufacturing many of them paid on
a commission basis, the coefficient of variation is 62.8 percent while for
sales clerks it is 29.8 percent. When multiplied by mean levels of
compensation for full time workers in these occupations, these CVs translate
into output standard deviations of $15000 and $5228.

For most of the managerial and technical jobs studied physical measures
of output were not definable so the supervisors were asked to report dollar
amounts of output expected from workers at the 15th, 50th and 85th percentiles
of the job performance distribution. Coefficients of variation averaged
36 percent for technicians implying an output standard deviation of $13668.
The coefficient of variation was 33 percent for low level managers and 20.6
percent in the only three service occupations for which data is available.
It was felt that these three jobs represented too small a sample to produce
reliable estimates of the CV for all service jobs except police and fire
fighting so the estimate of the service CV employed in the rest of the paper
is an unweighted average of the CVs for operatives, low skill clerical workers
and 20.6, the average for the three service jobs for which there is data
on the variability of output. While the standard deviation of output appears
to be substantial (about $4000) in full time full year service jobs, there
is clearly a positive correlation between average wage levels and SD$'s.

Methods used to Estimate the Coefficient of
Variation and Standard Deviations of Output

PO -   Physical Output - Where a piece rate prevails, ticket earnings are
         used as the output measure. Where pay is hourly, physical quantity
         of output or percent of standard output for the job is used as the
         output measure. CV's are calculated from this data and SD$s are
         constructed by using value added per employee (adjusted for relative
         wage rates) to value the productivity of the average worker.

WS -   Work Sample - A sample of the job tasks is taken and workers are
         observed performing these tasks under controlled conditions. To
         be useful for calculating a CV, the WS must be defined in units that
         have a ratio scale that corresponds to output such as 50 lb sacks
         carried from A to B. It measures peak performance and thus probably
         does not measure effort as actually applied to a real job. SD$s
         are calculated from CV's in same way they are calculated from PO
         based CV's.

GS -   Gross Sales - CV's are the SD of sales across sales personnel divided
         by the mean level of sales. SD$ equals the CV times the mean
         compensation of sales personnel. GS(A) is calculated using a weighted
         average of the sales of different products.

SHMM -   Schmidt, Hunter, McKenzie and Muldrow (1979) Method. Managers who
         supervise job incumbents are asked to place monetary values on the
         output produced by an employee at the 15th, 50th and 85th percentile
         of the job performance distribution. The metric in which they are
         asked to make these judgement is the cost to have an "outside firms
         provide these products and services." This yields direct estimates
         of SD$ and a rough estimate of the CV can be calculated from $(P_{85} -
         P_{15})/2P_{50}$.

S(m) -   Schmidt et al (1979) method with supervisors making their judgments
         after being supplied a mean output derived from company records.

S(T)-   Schmidt et al (1979) method with outliers dropped from the
         calculation.

SE -   Supervisor's estimate for actual employees. Supervisors give dollar
         values for the productivity of a sample of actual employees. The
         mean and standard deviation is calculated from this distribution.

S(D) -   Schmidt et al (1979) method as modified by Dunnette et al (1982).
         A first round of workshops with supervisors identified examples of
         unusually effective, unusually ineffective and average levels of
         job performance by plant operators. Eight dimensions of performance
         were developed from these examples and supervisors were asked to
         retranslate and scale the 667 performance examples in a second round
         of workshops. Finally participants were asked to estimate dollar
         value of performance at the 85th, 50th and 15th percentile. Negative
         values were changed to zero.

TABLE 1

UNSKILLED AND SEMISKILLED BLUE COLLAR WORKERS

	C.V. of Output (Incumb)	Standard Deviation in 1985 Dollars[a]	Method	Sample Size	Source
Hourly or Weekly Pay					
Butter Wrappers	18.4	(4129)	PO	8	Rothe (1946)
Machine Operators	20.5	(6411)	PO	130	Rothe (1947)
Electrical Workers	13.2	(3399)	PO	33	Tiffin (1947)
Assembly Worker	12.8	(4035)	PO	294	Barnes (1958)
Coil Winders	15.0	(3782)	PO	27	Rothe & Nye(1958)
Craft	7.5	$2364	PO	61	Rothe & Nye (1958)
Machine Operators	11.7	$3688	PO	37	Rothe & Nye (1959)
Radial Drill Operator	25	$7881	CA		Roche (1961)
Entry Level Steelworkers	13.7	(6064)	WS	249	Arnold et al. (1983)
Entry Level Steelworkers	6.8	$3000	SHMM	NA	Rauschenberger (1986)
Armor Crewman	16.2		WS	374	Vineberg & Taylor (1972)
Pay Form: Unknown					
Machine Operator	9.1		PO	76	Baumberger (1921)
Soap Wrappers	8.9		PO	30	Wyatt (1927)
Tile Sizing & Sorting	19.1		PO	18	Wyatt (1932)
Paper Sorters	8.7		PO	18	Hearnshaw (1937)
Lamp Shade Manufac.	8.6	(2805)	PO	19	Stead & Shartle (1940)
Wool Pullers	15.1	(2256)	PO	13	Lawshe (1948)
Machine Sewers	14.6	(1732)	PO	100	Wechsler (1952)
Electrical Workers	12.7	(3279)	PO	65	Wechsler (1952)
Cable Makers	17.7	(4596)	PO	40	McCormick & Tiffin (1974)
Electrical Workers	14.1	(3638)	PO	138	McCormick & Tiffin (1974)
Assemblers	19.6	(6095)	PO	35	McCormick & Tiffin (1974)
	14.0	$ 5062			

Estimates of standard deviation of the output (SD$) of full time full year workers that are presented in parenthesis were derived from coefficients of variation (CV) for output. For jobs outside of mining,retailing and finance it was assumed that a more capable worker would necessitate proportionately more materials, energy inputs, overhead labor inputs but not necessitate additional capital. This means that the metric of the CV is K-L productivity and thus that in manufacturing where the ratio of value added to compensation is 1.51, a 10 percent gain in K-L productivity has a dollar value equal to about 15 percent of compensation. Consequently, $SD\$_j = CV_j$ (GNP per full time equivalent worker in industry k)(wage$_{kj}$/(wage$_k$) where wage$_{kj}$ = average wage of occupation j in industry k and wage$_k$ is average wage in industry k. The ratio of occupation "j"s earnings to the industry average was derived from Table 2 of Occupation by Industry Subject Report of the 1980 Census.

Table 2

PRECISION PRODUCTION AND CRAFT OCCUPATIONS

	C.V. of Output (Incumb)	Standard Deviation in 1985 Dollars	Method	Sample Size	Source
Plant and System Operators					
Nuclear Control Room Oper.	108	$277,850	S(D)	34	Dunnette et al. (1982)
Fossil Fuel Cont. Room Oper.	72	$155,340	S(D)	48	Dunnette et al. (1982)
Nuclear Plant Operator	105	$ 97,370	S(D)	19	Dunnette et al. (1982)
Fossil Fuel Plant Operator	61	$ 39,455	S(D)	20	Dunnette et al. (1982)
Hydro Plant Operator	53	$ 27,030	S(D)	31	Dunnette et al. (1982)
Refinery Head Operator	--	$ 15,355	SE	19	Wroten (1984)
Outside Operator	--	$ 14,356	SE	19	Wroten (1984)
Pump Operator	--	$ 10,381	SE	17	Wroten (1984)
		$ 91,020			
Other Craft Workers					
Welders-Refinery	37.3	$ 16,775	SE	14	Wroten (1984)
Handcraft Workers	17.1	$ 5,390	PO	NA	Evans (1940)
Drillers	31	$ 9,772	PO	11	Lawshe (1948)
Arc Welder	16.0		WS	49	U.S. Job Service (1966)
Radar Mechanics [1]	40.3		WS	107	Whipple (1969)
Radar Mechanics [2]	20.1		WS	51	Whipple (1969)
Welders	13.7	$ 5,039	PO	25	Rothe (1970)
Repairman	21.4		WS	385	Vineberg & Taylor (1972)
Outside Mechanic	48.4	$ 21.800	SE	12	Wroten (1984)
Electrician	23	$ 12,539	SHMM	104	MacManus (1986)
Sheet Metal Worker	25	$ 11,696	SHMM	22	MacManus (1986)
Plumber	24	$ 11,856	SHMM	66	MacManus (1986)
Painter	24	$ 8,626	SHMM	41	MacManus (1986)
Meat Cutter	26	$ 7,778	SHMM	14	MacManus (1986)
Maintenance & Tool Room Jobs	46	--	SHMM		Bolda (1985)
	27.6	$ 12,399			
Supervisors					
Steel: Foreman (average)	--	$ 67,923	SHMM	11	Rauschenberger (1985)

The data on electric utility industry was collected in 1981 so the inflation factor based on the growth of utility wages and salaries per FTE is 1.30. The petroleum refinery industry inflation factor since 1983 is 1.10. The steel industry inflation factor is 1.084 for 1985 vs. 1982.

TABLE 3

CLERICAL

Routine Clerical Jobs

Telegraph Operator	13.2		PO	14	Baumberger (1920)
Machine Bookkeepers	8.4		PO	39	Hay (1943)
File Clerks	17.9		PO	61	Gaylord (1951)
Card Punch Operator	11.5	(2488)	PO	NA	Klemmer & Lockhead (1962)
Proof Machine Operator	13.4	(2932)	PO	NA	Klemmer & Lockhead (1962)
Typists	18.6	(3980)	PO	616	Stead & Shartle (1962)
Card Punch Operator (Day)	10.7	(2278)	PO	113	Stead & Shartle (1962)
Card Punch Operator	21.6	(4550)	PO	62	Stead & Shartle (1962)
Card Punch Operator	12.9	(2746)	PO	121	Stead & Shartle (1962)
Proofreader	18.5		WS	57	US Job Service (1972)
Telephone Operator	17.7		WS	1091	Gael et al. (1975a)
Mail Carriers	22.5		WS	374	US Postal Service (1981)
Mail Handlers	22.7		WS	373	US Postal Service (1981)
Clerical	25	$ 5529	S(M)	91	Burke (1985)
Customs Inspector	15.7		WS	188	Corts et al. (1977)
Meter Reader	18	$ 4481	SHMM	14	MacManus (1986)
Toll-Ticket Sorters	<u>14.9</u>	<u> </u>	PO	13	Maier & Verser (1982)
	16.7	$ 4934			

Clerical with Decision Making

Supply Specialist	26.5		WS	394	Vineberg & Taylor (1977)
Mail Distribution	39.2		WS	417	US Postal Service (1981)
Claims Processor	28.5	$ 5111	CA	15	Ledvinka et al. (1983)
Claims Evaluators	24.5	$ 4896	PO	176	DeSimone et al. (1986)
" "	23.8	$ 3876	SHMM	27	" " "
Claims Authorizer	20.5		WS	233	Trattner et al (1977)
Ticket Agent	26	$ 8411	SHMM	9	MacManus (1986)
Head Teller - Bank	<u>(15)</u>	<u>$ 2369</u>	S(T)		Mathieu & Leonard (1986)
	25.5	$ 8925			

TABLE 4

MANAGERIAL, TECHNICAL, SALES AND SERVICE WORKERS

Technical

Computer Programmer	32	$16550	SHMM		Schmidt et al. (1979)
Budget Analyst	(47)	$15062	SHMM		Hunter & Schmidt (1982)
Park Ranger	33	$ 4828	SHMM		Schmidt et al. (1984)
Instrument Tech. - Refinery	(20)	$28720	SE	14	Wroten (1984)
Computer Programmer	47	$15888	SHMM		Rich & Boudreau (1986)
Cartographic Technician	33.5	_____	WS	443	Campbell et al. (1973)
	33.8	$13668			

Managerial

Convenience Store Manager	51	$13967	SHMM	110	Weekley et al. (1985)
Bank Branch Manager	(35)	$10064	S(T)		Mathieu & Leonard (1986)
Bank Operations Manager	(14)	$ 3122	S(T)		Mathieu & Leonard (1986)
	33.3				

High Level Sales

District Sales - Food Manu.	32	($ 8958)*	SHMM	4	Cascio & Silbey (1979)
Insurance Salesman	37.5	$ 5219	CA	92	Bobko (1983)
District Sales Rep. Mfg.	41.3	$17529	GS	18	Burke & Frederick (1984)
Real Estate Sales	83	$21271	SHMM	63	MacManus (1986)
Life Insurance Sales	120	$12453	GS		Brown (1981)
	62.8				

Sales Clerk

Sales Clerks	22.2	(2807)	GS	153	Stead & Shartle (1940)
Cashiers	17.3	(2147)	WS	29	Lawshe (1948)
Sales Clerks	47.3	(5734)	GS	18	Lawshe (1948)
Grocery Checker	19.3		WS	92	US Job Service (1976)
Cashier Checker	43	$11379	SHMM	29	MacManus (1986)
	29.8	$ 5228			

Service

Cooks	21.4		WS	385	Vineberg & Taylor (1972)
Package Wrappers	24.1		PO	27	Blum & Candee (1941)
Package Packers	16.4		PO	10	Blum & Candee (1941)
Average of 3	20.6				
Average of Service, Low Clerical & Operatives	17.3	$ 4068			

Footnotes for Table 3

[a]The Programmer Aptitude Tests raw validity is .38 based on Schmidt, Rosenberg and Hunter's (1980) validity generalization of data on 1299 programmers.

[b]The estimate of GMA job performance raw validities for technical jobs is based on 20 occupations and a total of 2417 cases. The estimate for professional occupations is based on 2 occupations and a total of 109 cases. Schmidt, Mack & Hunter classify the park ranger job as a level 3 job using Hunters (1983) classification scheme. For a level 3 job the raw validity of GMA is .28.

[c]GMA raw validity for managers is a simple average of 9 separate managerial occupations from the GATB manual.

[d]The raw validity estimate is from Churchill et al's "The Determinants of Sales Person Performance: A Meta-Analysis" (1985) and is based on 44 studies which used objective company data with controls for environmental conditions. Since actual sales data were used it is assumed that criterion reliability is 1.0.

[e]Cascio and Silbey estimated the average compensation of sales personnel to be $75 a day or $18000 a year in 1978. This was inflated to 1985 wage levels by multiplying by 1.555 and then multiplied by CV to estimate SD$.

[f]Bobko et al, SHMM type estimate of SD$ was $4967 which is inflated to 1985 wage levels by multiplying by 1.174 the growth of wages and salaries in the industry from 1982 to 1985.

[g]Pearlman, Schmidt, and Hunter 1980.

[h]Validity estimate for sales clerk jobs is an average of Ghiselli's estimate (-.06) and the mean of more recent studies (.14) is reported by Hunter and Hunter (1984).

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WORK RELATED SECTION

66. This section contains a list of activities. For each activity in the list, decide how much you would like to do that activity. Don't worry about whether you would be good at it or whether you have experience with it. Just indicate how much you would like to do the activity by filling in the bubble in the appropriate column.

Rating scale (left to right): Dislike Very Much / Dislike / Indifferent / Like / Like Very Much

Activity	DVM	D	I	L	LVM
Read books or magazines about science	○	○	○	○	○
Take dance lessons	○	○	○	○	○
Read books about relationships	○	○	○	○	○
Keep your room clean and organized	○	○	○	○	○
Start your own school club	○	○	○	○	○
Keep track of finances for a club or business	○	○	○	○	○
Do yard work	○	○	○	○	○
Work with a chemistry set	○	○	○	○	○
Make new friends	○	○	○	○	○
Work with a calculator	○	○	○	○	○
Fix a bicycle	○	○	○	○	○
Paint a picture	○	○	○	○	○
Keep your desk neat	○	○	○	○	○
Paint houses	○	○	○	○	○
Study Geometry	○	○	○	○	○
Sort mail	○	○	○	○	○
Write letters to friends	○	○	○	○	○
Give a speech in class	○	○	○	○	○
Solve math problems	○	○	○	○	○
Sell something	○	○	○	○	○
Fix electrical appliances or gadgets	○	○	○	○	○
Visit an art museum	○	○	○	○	○
Run for an elective office	○	○	○	○	○
Build something from wood	○	○	○	○	○
Study Chemistry	○	○	○	○	○
Talk to friends on the telephone	○	○	○	○	○
Take a bookkeeping course	○	○	○	○	○
Solve complex technical problems	○	○	○	○	○
Act in a play	○	○	○	○	○
Greet people as they enter an office or store	○	○	○	○	○

Activity	DVM	D	I	L	LVM
Work with metal	○	○	○	○	○
Lead a group	○	○	○	○	○
Play in a musical group	○	○	○	○	○
Study Physics	○	○	○	○	○
Design furniture	○	○	○	○	○
Write a business letter	○	○	○	○	○
Study Biology	○	○	○	○	○
Attend school club meetings	○	○	○	○	○
Influence other people	○	○	○	○	○
Go to parties	○	○	○	○	○
Supervise the work of others	○	○	○	○	○
Fix a telephone or lamp	○	○	○	○	○
Type letters on a typewriter or word processor	○	○	○	○	○
Sculpt or paint	○	○	○	○	○
Work on cars	○	○	○	○	○
Perform science experiments	○	○	○	○	○
Attend sports events with friends	○	○	○	○	○
File letters, reports, records, etc.	○	○	○	○	○
Use a telescope or microscope	○	○	○	○	○
Compose a song	○	○	○	○	○
Belong to social clubs	○	○	○	○	○
Help others with their personal problems	○	○	○	○	○
Run a copy machine	○	○	○	○	○
Work with tools	○	○	○	○	○
Write short stories or poetry	○	○	○	○	○
Meet important people	○	○	○	○	○
Drive a truck or tractor	○	○	○	○	○
Debate a subject with another student	○	○	○	○	○
Read poetry	○	○	○	○	○

67. What is the lowest wage you would be willing to accept for a job while you are still in high school?
   - ○ less than $2.50/hr
   - ○ $2.50 - 3.50/hr
   - ○ $3.50 - 4.00/hr
   - ○ $4.00 - 4.50/hr
   - ○ $4.50 - 5.00/hr
   - ○ $5.00 - 6.00/hr
   - ○ $6.00 - 7.00/hr
   - ○ $7.00 - 8.00/hr
   - ○ $8.00 - 9.00/hr
   - ○ over $10.00/hr

68. What is the lowest wage you would be willing to accept for a job after you graduate from high school?
   - ○ less than $2.50/hr
   - ○ $2.50 - 3.50/hr
   - ○ $3.50 - 4.00/hr
   - ○ $4.00 - 4.50/hr
   - ○ $4.50 - 5.00/hr
   - ○ $5.00 - 6.00/hr
   - ○ $6.00 - 7.00/hr
   - ○ $7.00 - 8.00/hr
   - ○ $8.00 - 9.00/hr
   - ○ over $10.00/hr

69. The table below is used to determine your level of experience based upon courses you have taken or jobs you have held. In addition, the last column asks if you are interested in getting certain types of jobs either next summer or after you graduate. (Mark as many as apply for each item.)

	Courses/Classes		Work for wages or family business		Current or most Recent Job	Interested in future work
	One	Two or More	6 weeks and under	Over 6 weeks		
Agriculture and Horticulture	O	O	O	O	O	O
Lawn mowing and gardening	O	O	O	O	O	O
Auto mechanics/body	O	O	O	O	O	O
Camp counselor (day or overnight)	O	O	O	O	O	O
Child care	O	O	O	O	O	O
Cleaning/Building maintenance	O	O	O	O	O	O
Commercial arts	O	O	O	O	O	O
Computer programming or operator	O	O	O	O	O	O
Construction, general	O	O	O	O	O	O
Carpentry & cabinet making	O	O	O	O	O	O
Electrical	O	O	O	O	O	O
Masonry	O	O	O	O	O	O
Plumbing	O	O	O	O	O	O
Painter/paper hanger	O	O	O	O	O	O
Cosmetology, hairdressing	O	O	O	O	O	O
Drafting	O	O	O	O	O	O
Electronics	O	O	O	O	O	O
Home economics including diet	O	O	O	O	O	O
Machine shop/Factory work	O	O	O	O	O	O
Medical or dental assisting	O	O	O	O	O	O
Nursing, other health	O	O	O	O	O	O
Newspaper or magazine publishing	O	O	O	O	O	O
Newspaper delivery	O	O	O	O	O	O
Restaurant occupations, general	O	O	O	O	O	O
Cook	O	O	O	O	O	O
Waitperson or busperson	O	O	O	O	O	O
Sales or merchandising	O	O	O	O	O	O
Secretarial and office work	O	O	O	O	O	O
Truck, bus or taxi driving	O	O	O	O	O	O
Welding	O	O	O	O	O	O
Delivery--Mail, Express packages	O	O	O	O	O	O
Army/Navy/Air Force/Marines	O	O	O	O	O	O
Hotel/Resort staff	O	O	O	O	O	O
Bank teller/Financial sales	O	O	O	O	O	O
Police/Guard/Fire fighting	O	O	O	O	O	O
Other	O	O	O	O	O	O

70. How fast can you type accurately?
   O I cannot type
   O Under 20 words per minute
   O 20-30 words per minute
   O 30-40 words per minute
   O 40-50 words per minute
   O 50-60 words per minute
   O over 60 words per minute

71. How much do others depend on you when there is work to be done?
   O not very much
   O quite a bit
   O very much

72. About how many friends do you see socially (outside of school) at least once a month?
   O none
   O a few
   O many

73. When you have a different opinion than others, what do you usually do?
   O keep your opinion to yourself
   O voice your opinion only to people you think will agree with you
   O voice your opinion freely

74. How often do you put all of your effort into the things you do?
   - ○ almost always
   - ○ most of the time
   - ○ some of the time

75. During your last full year of high school, how often were you more than 10 minutes late for school?
   - ○ never
   - ○ once or twice
   - ○ three or more times

76. Which do you like better - being with other people or being by yourself?
   - ○ being by myself
   - ○ I like both about the same
   - ○ being with other people

77. How often do you state your opinions or answer questions in class, without having to be called on by the teacher?
   - ○ often
   - ○ sometimes
   - ○ almost never

78. Are you interested in working during the school year?
   - ○ No
   - ○ Yes--if yes, on which days are you interested in working (mark all that apply)
       - ○ Saturday
       - ○ Sunday
       - ○ Weekdays after school

79. How often do you do extra work that is not required?
   - ○ often
   - ○ sometimes
   - ○ once in awhile

80. During your last full year of school, how many homework assignments did you hand in late?
   - ○ 0 or 1
   - ○ 2 to 4
   - ○ 4 or more

81. During the past year, about how many times did you start a conversation with a complete stranger?
   - ○ many times
   - ○ a few times
   - ○ almost never

82. When you are with a group of people, are you the one who decides what the group will do?
   - ○ yes, usually
   - ○ yes, sometimes
   - ○ no, not usually

83. How hard do you usually work?
   - ○ not very hard
   - ○ somewhat hard
   - ○ very hard

84. Have you ever received an award for perfect attendance?
   - ○ no
   - ○ yes

85. How much do you like to meet new people?
   - ○ I like it a lot
   - ○ I like it a little
   - ○ I don't like it very much.

86. How many times have you given a talk in front of a group of people?
   - ○ never
   - ○ once or twice
   - ○ three or more times

87. Are you interested in working during the next summer?
   - ○ No
   - ○ Yes--if yes, how many hours would you be willing to work?
       - ○ less than 20 hours per week
       - ○ 20 - 30 hours per week
       - ○ 30 - 40 hours per week
       - ○ over 40 hours per week

88. Have you ever failed a test because you didn't study?
   - ○ yes, several times
   - ○ yes, once
   - ○ no, never

89. How often does an adult have to remind you to take care of your responsibilities?
   O pretty often
   O sometimes
   O almost never

90. Which of the following kinds of activities do you do most often?
   O group activities (e.g., team sports, parties, or clubs)
   O I do about equal amounts of group and individual activities
   O activities that you do by yourself (e.g., reading, jogging, or playing video games alone)

91. How good are you at convincing others to see things your way?
   O very good
   O somewhat good
   O not very good

92. During the past year, about how many times did you set a goal to do better than anyone else on something?
   O many times
   O a few times
   O very few times or never

93. How would you feel if you turned in a homework assignment late?
   O I'd feel happy just to have finished the assignment.
   O I'd feel a little embarrassed or guilty for handing it in late.
   O I'd feel very embarrassed or guilty for handing it in late.

94. Which would you like better - going to a small party where you know everyone or going to a large party where there are a lot of people you don't know?
   O going to a large party where there are a lot of people you don't know
   O going to a small party where you know everyone
   O I don't like any kind of parties

95. Have you ever won an award for selling something?
   O I have never sold anything
   O no
   O yes

96. Are you interested in a summer job that would involve living away from home?
   O No
   O Yes

97. How important is it to you to do an excellent job on things?
   O very important
   O somewhat important
   O not very important

98. How would most of your teachers describe you?
   O always prompt and responsible in completing homework assignments
   O usually prompt and responsible in completing homework assignments
   O somewhat careless about turning in assignments on time

99. Would your teachers say you are talkative?
   O no, they would say I'm not very talkative
   O yes, they would say I'm somewhat talkative
   O yes, they would say I'm very talkative

100. When you argue with friends or classmates, how often do you win the argument?
   O most of the time
   O about half of the time
   O less than half of the time

101. In the past, how often have you done an excellent job on hobbies or projects that interested you?
   O sometimes
   O often
   O almost always

102. Would your teachers say they can always count on you to do your homework?
   O yes, most would
   O yes, some would
   O no, most would not

103. Have you ever participated in a student exchange program where you visited another school, city, state, or country?
   O no, never
   O yes, once
   O yes, more than once

104. **Are you a leader in your group of friends?**
    ○ yes, usually
    ○ yes, sometimes
    ○ no, not usually

105. **In the past, how often were you successful at things you really wanted to do well on?**
    ○ almost always
    ○ often
    ○ sometimes

106. **How many times have you failed to show up for a meeting, appointment, or practice session that you had agreed to attend?**
    ○ never
    ○ once or twice
    ○ three or more times

107. **How many people do you have a hard time getting along with?**
    ○ many
    ○ quite a few
    ○ one or two

your last full year of school, were you ever in charge of a committee or a class project group?
    ○ no, never
    ○ yes, once
    ○ yes, more than once

109. **How many classes have you failed since you started high school?**
    ○ more than three
    ○ one or two
    ○ zero

110. **How often have you let your friends down by not doing something you had promised to do?**
    ○ pretty often
    ○ a few times
    ○ almost never

111. **Are you a good "team player"?**
    ○ yes, most of the time
    ○ yes, some of the time
    ○ no, not usually

112. **Have you ever had a paid job supervising others (besides family members)?**
    ○ yes
    ○ no

113. **Do you get tired or worn out very easily?**
    ○ yes, pretty often
    ○ yes, but not very often
    ○ no, almost never

114. **How often are you responsible for taking care of someone besides yourself?**
    ○ often
    ○ sometimes
    ○ once in awhile

115. **During the past year, how many times did you get into a serious argument with other people at school or in your neighborhood?**
    ○ almost never
    ○ a few times
    ○ many times

116. **Have you ever won an award for leadership?**
    ○ no
    ○ yes

117. **How do most of your teachers think of you?**
    ○ active and enthusiastic most of the time
    ○ active and enthusiastic some of the time
    ○ not very active or enthusiastic

118. **How often have you been sent to the principal's or counselor's office for breaking rules at school?**
    ○ often
    ○ sometimes
    ○ almost never

119. **Compared to others your age, are you easier or harder to get along with?**
    ○ I am easier to get along with than others
    ○ I am about as easy to get along with as others
    ○ I am harder to get along with than others

120. **Which do you prefer - to be the leader of a group or to be one of the followers?**
    ○ usually prefer to be the follower
    ○ sometimes prefer to be the leader and sometimes prefer to be a follower
    ○ usually prefer to be a leader

121. **Can you work for a long time without feeling tired?**
    ○ no, usually not
    ○ yes, sometimes
    ○ yes, most of the time

122. **How many times have you been suspended or expelled from school in the last two years?**
    ○ more than once
    ○ once
    ○ never

123. **Would your teachers say that you are cooperative?**
    ○ yes, most would
    ○ yes, some would
    ○ no, most would not

124. **During the past year, how often were you in a position where you had to tell others what to do?**
    ○ almost never
    ○ a few times
    ○ many times

125. **How much energy do you have compared to other people?**
    ○ I have more energy than other people
    ○ I have about the same amount of energy as other people
    ○ I have less energy than other people

126. **Have you ever pretended to be sick just to miss a day of school?**
    ○ no, never
    ○ yes, once or twice
    ○ yes, three or more times

127. **In the past year, has anyone told you that it takes a lot to make you mad?**
    ○ no
    ○ yes

128. **How much do you like to be in charge of others?**
    ○ like it very much
    ○ like it a little
    ○ don't like it very much

129. **When someone gives you a job to do, how do you usually feel?**
    ○ I often wish I didn't have to do it
    ○ I'm ready to start work but not excited about it
    ○ I can't wait to start

130. **Would your teachers say you are respectful and obedient?**
    ○ yes, most would
    ○ yes, some would
    ○ no, most would not

131. **How often do you get angry with others?**
    ○ often
    ○ sometimes
    ○ almost never

132. **Have you ever been a class or club officer?**
    ○ yes, more than three times
    ○ yes, once or twice
    ○ no, never

133. **During the past year, how often did you leave a boring task unfinished?**
    ○ often
    ○ sometimes
    ○ almost never

134. Do you know how to use any of the following computer programs? (Mark all that apply.)

O Word Perfect	O Microsoft Word	O Word for Windows	O Word for Mac
O Word Star	O Multimate	O Displaywrite	O Other word processing

O Lotus 123	O Excel (IBM or Mac)	O Quattro	O Supercalc
O Symphony	O Plan Perfect	O Multiplan	O Other spreadsheet

O DBase	O Oracle	O Paradox	O Other database programs

O Harvard Graphics	O Lotus Freelance	O Corel Draw	O Other graphic programs

O BASIC	O C Language	O FORTRAN	O Other programming languages

O Other computer programs (not including games)

135. Would you be able to get to a job site that is not within walking distance of your home and not accessible to public transportation?

O Yes, I have a drivers license and access to a car.

O Yes, family and friends are willing to drive me.

O No, a job must be accessible to public transportation or within walking distance of my home.

ACTIVITIES SECTION

136. Since you have been in high school, have you taken part in any of the following activities?

    (MARK ALL THAT APPLY)

    O Art Club

    O Athletic teams--in or out of high school

    O Band, orchestra, or playing a musical instrument

    O Cheerleaders, pep club, majorettes, drill team

    O Chorus or dance

    O Church activities, including youth groups

    O Computer club

    O Debate Club or Team

    O Drama or theater

    O Future Farmers of America or 4H

    O History Club

    O Hobby clubs such as photography, crafts model building or electronics

    O Honorary clubs, such as Beta Club or National Honor Society

    O Junior Achievement

    O Language Club, French, Spanish, etc.

    O Mathematics club

    O School newspaper, magazine or yearbook

    O Science club

    O Scouts, Indian Guides, Campfire

    O Student council, student government

    O Vocational education clubs, such as Future Homemakers, Teachers, DECA, or FBLA

    O Youth organizations in the community, such as the YWCA or YMCA

137. From the list below, mark up to 5 hobbies or activities in which you are the most active.

    O Acting/Drama
    O Aerobics
    O Archery
    O Art Appreciation
    O Backgammon
    O Ballet
    O Band
    O Billiards
    O Bowling
    O Camping
    O Card playing
    O Carpentry
    O Chess
    O Choir/Singing
    O Coin Collecting
    O Concert going
    O Cooking
    O Crocheting/knitting
    O Farming
    O Fishing
    O Gardening
    O Hiking
    O Hunting
    O Ice skating
    O Jogging
    O Journalism
    O Lettering/Drawing
    O Metal work
    O Model making
    O Movie making
    O Museums
    O Needlepoint/embroidery
    O Painting
    O Parachuting
    O Performing arts
    O Photography
    O Playing a musical instrument
    O Puzzles/games
    O Radio broadcasting
    O Reading
    O Scuba diving
    O Sewing
    O Skateboarding
    O Skiing
    O Snowmobiling
    O Special Olympics (athlete)
    O Special Olympics (coordinator)
    O Spelunking
    O Stamp collecting
    O Table tennis
    O Theatre/Production
    O Writing/composition
    O Video/Computer games

21. Have you taken the Scholastic Aptitude Test (SAT)?
- ○ No
- ○ Yes   If yes, please indicate your most recent SAT scores. (Best estimate)

Verbal

	⓪	⓪
	①	①
②	②	②
③	③	③
④	④	④
⑤	⑤	⑤
⑥	⑥	⑥
⑦	⑦	⑦
⑧	⑧	⑧
	⑨	⑨

Math

	⓪	⓪
	①	①
②	②	②
③	③	③
④	④	④
⑤	⑤	⑤
⑥	⑥	⑥
⑦	⑦	⑦
⑧	⑧	⑧
	⑨	⑨

22. Have you taken the Preliminary American College Test (PACT)?
- ○ No
- ○ Yes   If yes, please indicate your most recent composite score (Best estimate):

⓪	⓪
①	①
②	②
③	③
	④
	⑤
	⑥
	⑦
	⑧
	⑨

23. Have you taken the American College Test (ACT)?
- ○ No
- ○ Yes   If yes, please indicate your most recent composite score (Best estimate):

⓪	⓪
①	①
②	②
③	③
	④
	⑤
	⑥
	⑦
	⑧
	⑨

24. Have you taken or do you plan to take the "Test of English As a Foreign Language" (TOEFL)? (Mark only one answer.)
- ○ I do not plan to take the TOEFL
- ○ I plan to take the TOEFL in the future
- ○ I have already taken the TOEFL

If you have already taken TOEFL, please indicate your score. (Best estimate)

⓪	⓪	⓪
①	①	①
②	②	②
③	③	③
④	④	④
⑤	⑤	⑤
⑥	⑥	⑥
	⑦	⑦
	⑧	⑧
	⑨	⑨

25. Which College Board Achievement Test have you taken, if any: (Mark all that apply.)
- ○ None taken
- ○ English Composition
- ○ Math
- ○ Foreign Language
- ○ Natural Science
- ○ History

26. Please mark your approximate high school class rank: (Mark only one answer.)
- ○ Top 1% of students in my class
- ○ Top 5%   ○ Top 30%   ○ Top 60%
- ○ Top 10%   ○ Top 40%   ○ Top 70%
- ○ Top 20%   ○ Top 50%   ○ Other
- ○ Not yet determined or don't know

27. How many semesters (a semester is one half year) of the following high school courses (beginning with grade 9) have you completed, including those you are now taking? If you have repeated a course, please count it only once.

Vocational/Occupational
Arts and Music
English
Foreign Languages
Mathematics
Natural Sciences
Social Studies

	V/O	A&M	Eng	FL	Math	NS	SS
None	○	○	○	○	○	○	○
1 semester	○	○	○	○	○	○	○
2 semesters	○	○	○	○	○	○	○
3 semesters	○	○	○	○	○	○	○
4 semesters	○	○	○	○	○	○	○
5 semesters	○	○	○	○	○	○	○
more than 5 semesters	○	○	○	○	○	○	○

For each subject listed on the next page, please mark the statement that best describes your grades in that subject. Do not answer both Pass/Fail and a letter grade.

27. Continued

	Vocational/Occupational	Arts and Music	English	Foreign Languages	Mathematics	Natural Sciences	Social Studies
Mostly A (91-100 or 3.6-4.0)	○	○	○	○	○	○	○
About half A and half B (85-90 or 3.0-3.5)	○	○	○	○	○	○	○
Mostly B (80-85 or 2.5-3.0)	○	○	○	○	○	○	○
About half B and half C (75-80 or 2.0-2.5)	○	○	○	○	○	○	○
Mostly C (70-75 or 1.5-2.0)	○	○	○	○	○	○	○
About half C and half D (65-70 or 1.0-1.5)	○	○	○	○	○	○	○
Mostly D (60-65 or .5-1.0)	○	○	○	○	○	○	○
Mostly below D (below 60 or below .5)	○	○	○	○	○	○	○
Pass	○	○	○	○	○	○	○
Fail	○	○	○	○	○	○	○
Doesn't apply to me--my classes are not graded	○	○	○	○	○	○	○

Courses in the same subject often have different names reflecting the track or pace of the course. If you know, mark the label that best describes the courses that you have taken or are currently taking. Check all that apply. Example: you may have taken a regular English course **and** a college preparatory English course.

Everyone takes the same course	○	○	○	○	○
Honors, Accelerated	○	○	○	○	○
College preparatory	○	○	○	○	○
Standard	○	○	○	○	○
Basic	○	○	○	○	○

28. If Advanced Placement courses are offered in your school, please mark those courses in which you plan to enroll, are currently enrolled, or have completed.

○ No courses offered

	Plan to Enroll	Currently Enrolled	Scored less than 3	Scored 3 or better	Scored 4 or better
American Government and Politics	○	○	○	○	○
American History	○	○	○	○	○
Art History	○	○	○	○	○
Biology	○	○	○	○	○
Calculus	○	○	○	○	○
Chemistry	○	○	○	○	○
Comparative Government and Politics	○	○	○	○	○
Computer Science	○	○	○	○	○
Economics	○	○	○	○	○
English Language and Composition	○	○	○	○	○
English Literature and Composition	○	○	○	○	○
European History	○	○	○	○	○
French Language	○	○	○	○	○
French Literature	○	○	○	○	○
German Language	○	○	○	○	○
Latin	○	○	○	○	○
Music Listening and Literature	○	○	○	○	○
Music Theory	○	○	○	○	○
Physics	○	○	○	○	○
Spanish Language	○	○	○	○	○
Spanish Literature	○	○	○	○	○
Studio Art	○	○	○	○	○
Other Courses	○	○	○	○	○

29. Do you require any special needs services? (This information is requested because some institutions want to inform students about special programs or facilities designed to meet their specific needs.)

○ No, I do not require any special needs services.
○ Yes--If "yes" please mark those services you require from the list below
  ○ Special mobility training
  ○ A handicapped parking permit
  ○ Professional medical help
  ○ Speech therapy
  ○ A notetaker to help in my classroom lectures
  ○ Taking essay tests orally (rather than in written form)
  ○ An interpreter for classroom and other communication
  ○ A special diet
  ○ A guide dog
  ○ Special assistance with oral instructions
  ○ Textbooks, tests and/or handouts recorded on tape
  ○ An adaptive transportation system in order to commute within school
  ○ Assistance for Dyslexia
  ○ Brailler
  ○ Magnifying text reader
  ○ TDD (Telecommunications device for the deaf)
  ○ TV closed captioning device

30. During the school year, what is the average number of hours per week you are employed for pay or work as a volunteer? (Do not include jobs worked only during the summer or school vacations.)

	As a Volunteer	Worked for Pay
○ None		
10 hours or less per week	○	○
11 to 20 hours per week	○	○
More than 20 hours per week	○	○

31. Would you like to receive information about part-time/summer job opportunities or internships within the following categories?

○ No
○ Yes--If "yes", mark the two in which you are most interested from the list below.

○ Accounting Intern
○ Advertising Intern
○ Airline Reservations Clerk
○ Amusement or Theme Park Att.
○ Assistant Architect
○ Banking (Teller, Clerical, and entry level positions)
○ Summer Camps
○ Computer Programming Intern
○ Counselor for Learning Disabled or Physically Challenged Children
○ Construction
○ Door-to-door Salesperson
○ Government Intern
○ Hotel/Resort Attendant
○ Health Care (Medical, Dental, or Nursing Assistant)

○ Mail Services (Overnight Delivery)
○ Military (Officers Training Camp)
○ National Park Service (Trail Ranger, etc.)
○ Legal Assistant
○ Lifeguarding
○ Public Library
○ Public Museums
○ Restaurant (Cook, Waiter/Waitress, Cashier, Support)
○ Retailing
○ Scientific Research Assistant
○ Summer Engineer
○ Summer Theater
○ Supermarket Chain
○ Temporary Agency

JOBSCAN CHECKLISTS - INDEX AND EXAMPLES

JOBSCAN CHECKLISTS

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CARPENTERS

I TRADE CERTIFICATION

Please check (✔) your current trade certification.

A ☐ Certificate of Qualification, specify province: _____
B ☐ Certificate of Apprenticeship, specify province: _____
C ☐ Interprovincial Standards — Red Seal
D ☐ No formal certification (on-the-job training)
E ☐ Other, specify: _____

II TRADE STATUS/LENGTH OF EXPERIENCE

Please check (✔) your current trade status and total length of experience.

	i −2 yrs	ii 2-5 yrs	iii 5-10 yrs	iv +10 yrs
A Journeyman/woman with formal certification	☐	☐	☐	☐
B Journeyman/woman without formal qualifications	☐	☐	☐	☐
C Apprentice				
D Helper	☐	☐	☐	☐
E Other, specify:_____	☐	☐	☐	☐

C Apprentice
1 ☐ 1st period   3 ☐ 3rd period
2 ☐ 2nd period   4 ☐ 4th period

III OCCUPATIONAL INFORMATION

A MAJOR AREAS OF EXPERIENCE

Please check (✔) major area(s) of your experience and total length of experience.

	aa −2 yrs	bb 2-5 yrs	cc 5-10 yrs	dd +10 yrs
1 New commercial/institutional construction	☐	☐	☐	☐
2 New industrial construction	☐	☐	☐	☐
3 New residential construction	☐	☐	☐	☐
4 Building maintenance/construction	☐	☐	☐	☐
5 Road and bridge construction	☐	☐	☐	☐
6 Open cut construction (sewer, water main, gutter)	☐	☐	☐	
7 Renovation/Restoration/Retrofit	☐	☐	☐	☐
a ☐ interior b ☐ exterior				
8 Millwork/Prefab shopwork	☐	☐	☐	☐
9 Marine works/construction	☐	☐	☐	☐
10 Other, specify:_____	☐	☐	☐	☐

B GENERAL CARPENTRY EXPERIENCE

Please check (✔) your general carpentry experience and extent of experience.

	a Some work experience	b Extensive work experience
1 Rough carpentry	☐	☐
2 Finish carpentry	☐	☐

C SPECIFIC WORK EXPERIENCE

Please check (✔) specific work experience.

	aa Some work experience	bb Extensive work experience
1 Form Work — Concrete	☐	☐

   a ☐ Wall forms, slab and deck forms, flying forms, tilt up forms
   b ☐ Column/Pier footing forms, pile caps
   c ☐ Slip forms
   d ☐ Stair forms
   e ☐ Shop/Precast forms
   f ☐ Tunnel forms
   g ☐ Other, specify: _____

	aa Some work experience	bb Extensive work experience

2 <u>Framing</u> ☐ ☐

a ☐ Beams, sills, joists, and wall framing
b ☐ Stairs
c ☐ Roofs
d ☐ Exterior siding, soffit, facia, etc.
e ☐ Heavy timber construction
f ☐ Shoring/Cribbing
g ☐ Other, specify: _____

3 <u>Finishing</u> ☐ ☐

a ☐ Store fixture, cabinet installation
b ☐ Door and window installation
c ☐ Trim/Fixture installation
d ☐ Hardwood flooring installation
e ☐ Specialty millwork/panel systems installation
f ☐ Other, specify: _____

D ADDITIONAL WORK EXPERIENCE

Please check (✔) additional work experience.

1 ☐ Construction drawing/blueprint preparation
2 ☐ Blueprint/Drawing interpretation
3 ☐ Rigging and hoisting set-up
4 ☐ On-site/crane signalling
5 ☐ Elevation surveying/building site layout
6 ☐ On-site prefabing/cutting (sawyer)
7 ☐ Material/Quantity estimates
8 ☐ Tender/Quotation preparation
9 ☐ Other, specify: _____

E SUPERVISORY EXPERIENCE

1 Please check (✔) supervisory experience.
  a ☐ Project/Job supervision
  b ☐ Worker supervision
2 Please check (✔) largest crew ever supervised.

  a ☐ –5   b ☐ 5-10   c ☐ +10

F OTHER TRADE EXPERIENCE *

Please check (✔) other trade experience

1 ☐ Welding (oxy acetyline, electric arc)
2 ☐ Painting/Decorating
3 ☐ Drywall/Ceiling installation
4 ☐ Masonry/Brickwork
5 ☐ Cement finishing
6 ☐ Floor covering installation, specify: _____
7 ☐ Other, specify: _____

* specific trades JOBSCAN checklists are available for completion in the indicated areas.

G SPECIALTY WORK SETTING

Please check (✔) specialty work setting experience.

1 ☐ At heights   3 ☐ Underwater (hard hat diving)
2 ☐ Underground   4 ☐ Confined spaces

H MACHINERY/EQUIPMENT

Please specify machinery and/or equipment you are able to operate: _____
_____
_____

I – OCCUPATIONAL INFORMATION

A – LENGTH OF OFFICE EXPERIENCE

1 ☐ Less than 6 months
2 ☐ 6 months to 1 year
3 ☐ 1-2 years
4 ☐ 2-5 years
5 ☐ 5-10 years
6 ☐ Over 10 years

B – TYPING, DATA ENTRY, SHORTHAND PROFICIENCY

1 – Typing (Words per minute)

a ☐ Less than 25 wpm
b ☐ 25-40 wpm
c ☐ 40-50 wpm
d ☐ 50-60 wpm
e ☐ 60-70 wpm
f ☐ 70-80 wpm
g ☐ Over 80 wpm,

Specify: _____

2 – Data Entry (Strokes per hour)

a ☐ Less than 10,000 sph
b ☐ 10,000-11,500 sph
c ☐ 11,500-13,000 sph
d ☐ 13,000-14,500 sph
e ☐ 14,500-16,000 sph
f ☐ Over 16,000 sph.

Specify No. _____

3 – Shorthand (Words per minute)

a ☐ Less than 60 wpm
b ☐ 60-70 wpm
c ☐ 70-80 wpm
d ☐ 80-90 wpm
e ☐ 90-100 wpm
f ☐ 100-120 wpm
g ☐ Over 120 wpm,

Specify: _____

C – SPECIALIZED SECRETARIAL EXPERIENCE, COURT / PARLIAMENTARY REPORTING

	a Less than 6 months	b 6 months to 1 year	c 1-2 years	d 2-5 years	e 5-10 years	f Over 10 years
1 ☐ Legal Secretary	☐	☐	☐	☐	☐	☐
2 ☐ Medical Secretary	☐	☐	☐	☐	☐	☐
3 ☐ Administrative/Executive Secretary	☐	☐	☐	☐	☐	☐
4 ☐ Court/Parliamentary Reporter	☐	☐	☐	☐	☐	☐
5 ☐ Other Specialized Secretarial Experience,	☐	☐	☐	☐	☐	☐

Specify: _____
_____

D – TYPE OF DATA, TECHNICAL TERMINOLOGY

1 – Type of Data

a ☐ Correspondence
b ☐ Reports
c ☐ Contracts
d ☐ Statistics
e ☐ Financial Statements
f ☐ Invoices
g ☐ Charts, Tables, Graphs, Diagrams
h ☐ Publications, Manuscripts, Theses
i ☐ Other, Specify: _____

2 – Technical Terminology

(o) Specialized Experience

a ☐ Legal   ☐
b ☐ Medical   ☐
c ☐ Dental   ☐
d ☐ Engineering   ☐
e ☐ Scientific   ☐
f ☐ Financial   ☐
g ☐ Computer/Data Processing Terminology   ☐
h ☐ Other Technical Terminology,   ☐

Specify: _____

E – BUSINESS MACHINES / EQUIPMENT

1 ☐ Typewriter
2 ☐ Word Processor, Specify Type(s), (e.g. – IBM, Xerox, Wang, AES, Micom, etc.):

a ☐ Specialized Word Processing Programs Experience, Specify, (e.g. – Sort and Records Processing Programs, Edit Programs, Mathematical/Statistical Programs, etc.): _____

3 ☐ Computer Data Entry Terminal, Specify: _____
4 ☐ Keypunch
   a ☐ Alpha-numeric
   b ☐ Numeric
5 ☐ Automated/Electronic Office Equipment,
   Specify: _____
6 ☐ Teletype (Telex, Twx)
7 ☐ Stenotype
8 ☐ Typesetting Machine
9 ☐ Dictaphone
10 ☐ Addressograph

11 ☐ Switchboard, Specify No. of Lines: _____
12 ☐ Bookkeeping Machine
13 ☐ Duplicating Equipment, Specify: _____
14 ☐ Cash Register
15 ☐ Microfilm/Microfiche Equipment
16 ☐ Other, Specify: _____

F – GENERAL BUSINESS / OFFICE FUNCTIONS

1 ☐ Mail and/or Office Supplies Handling

2 ☐ Filed Documents and Other Records Using Standard Filing Procedures

3 ☐ Prepared Routine Material Following an Established Format and Instructions (Correspondence, Cheques, Applications, Purchase Orders, etc.)

4 ☐ Prepared Charts, Tables, Diagrams, Graphs According to Specified Instructions

5 ☐ Received General Public and/or Telephone Calls and Relayed Simple Information, Instructions or Messages

6 ☐ Interviewed General Public and/or Customer to Obtain Detailed Information for Completion of Forms, Documents, Applications and/or Orders

7 ☐ Classified and Maintained

   a ☐ Records and Files

   b ☐ Computer Tapes, Disks, etc.

8 ☐ Compiled Data and Statistics for Reports, Tables, Schedules, etc.

9 ☐ Coded Data for Computer Input

10 ☐ Performed Quality Control of Data Entry Material

11 ☐ Proofread

   a ☐ General Business Material

   b ☐ Complex Technical Material

12 ☐ Contacted Suppliers, Dealers, etc... to Request Prices; Determine Terms of Sale and Delivery; Verify, Place and Follow-up on Orders, etc.

13 ☐ Investigated and Resolved Customer Complaints and Claims.

14 ☐ Processed Customer Orders and Claims

15 ☐ Collected, Counted and Sorted Money, Cheques, Bonds, Coupons and Other Negotiable Items

16 ☐ Balanced Cash and Completed Balance Sheets, Cash Reports and Related Forms

17 ☐ Other, Specify: _____

G – ADMINISTRATIVE OFFICE FUNCTIONS

1 ☐ Arranged Travel, Related Itineraries and Bookings

2 ☐ Arranged and Co-ordinated Seminars, Conferences, Related Agendas and Bookings

3 ☐ Recorded and Prepared Minutes of Meetings, Seminars, Conferences, etc.

4 ☐ Examined and Checked Materials, Equipment, Inventory, etc. to Ensure Accuracy of Documents and Records, Completion of Orders or Conformance of Products to Specifications

5 ☐ Co-ordinated Flow and Distribution of Materials Within Internal Departments and/or Outside Organizations

6 ☐ Prepared and Updated Reports, Manuals, Documents, Tables, Schedules, Contracts, etc.

7 ☐ Edited Reports, Manuals, Documents, Tables, Schedules, Contracts, etc.

8 ☐ Composed General Correspondence

9 ☐ Compiled and Prepared Information Releases

10 ☐ Prepared Speeches and Material for Oral Presentations

11 ☐ Conducted Research Using Various Information Sources. Specify Areas of Research: _____

12 ☐ Calculated, Estimated and/or Forecasted Costs, Expenses, Revenues, Sales, etc.

13 ☐ Investigated and Adjusted Claims for Losses or Damages as per Terms, Policies or Agreements

14 ☐ Determined and Established Office Procedures and Routines

15 ☐ Delegated Work Assignments

16 ☐ Recruited and Selected Staff

17 ☐ Other, Specify: _____

H – BOOKKEEPING / ACCOUNTING EXPERIENCE

1 –

a ☐ General Ledger Maintenance

b ☐ Accounts Payable

c ☐ Accounts Receivable

d ☐ Trial Balance

e ☐ Journal Entry

f ☐ Petty Cash

g ☐ Banking

h ☐ Profit and Loss

i ☐ Payroll

   i ☐ Computerized

   ii ☐ Manual

j ☐ Credit and Collection

k ☐ Costing and Budgeting

l ☐ Inventory Control

m ☐ Basic Record Keeping

n ☐ Financial Statements

o ☐ Bank Reconciliations

p ☐ Tax and Audit

q ☐ Other, Specify: _____

2 – Bookeeping System(s)

a ☐ One – Rite System

b ☐ Double – Entry System

c ☐ Computerized Bookkeeping

d ☐ Other, Specify: _____

I – SUPERVISORY AND TRAINING EXPERIENCE

1 – Please check (√) if you have any supervisory experience

   ☐ Specify: _____

2 – Please check (√) length of your supervisory experience

a ☐ Less than 6 months   d ☐ 2-5 years

b ☐ 6 month to 1 year   e ☐ 5-10 years

c ☐ 1-2 years   f ☐ More than 10 years

3 – Please check (√) if you have trained and/or instructed other employees

   ☐ Please Specify Type of Training/Instruction Given: _____

II – BANK / TRUST COMPANY AND HOTEL EXPERIENCE

	1 Less than 6 months	2 6 months to 1 year	3 1-2 years	4 2-5 years	5 5-10 years	6 Over 10 years
A ☐ Bank/Trust Company	☐	☐	☐	☐	☐	☐
B ☐ Hotel	☐	☐	☐	☐	☐	☐

III – SECURITY CLEARANCE / BONDING

A ☐ Security Cleared, Specify Level: _____

B ☐ Bonded

C ☐ Eligible for Bonding

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COMPUTER OCCUPATIONS

I – OCCUPATIONAL INFORMATION

A – OCCUPATIONAL TITLES / LENGTH OF EXPERIENCE

	aa Less than 6 months	bb 6 months to 1 year	cc 1-2 years	dd 2-5 years	ee 5-10 years	ff More than 10 years
1 – Computer Operations						
a ☐ Net Control Operator i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
b ☐ Computer Operator/Production Control	☐	☐	☐	☐	☐	☐
i ☐ jr. ii ☐ int. iii ☐ Sr.						
c ☐ Peripheral Equipment Operator. Specify equipment: _____	☐	☐	☐	☐	☐	☐
d ☐ Other. Specify: _____	☐	☐	☐	☐	☐	☐
2 – Programming and Analysis						
a ☐ Application Programmer i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
b ☐ Systems Software Programmer i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
c ☐ Application Programmer Analyst i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
d ☐ Application Analyst i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
e ☐ Systems Software Analyst i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
f ☐ Data Base Analyst/Specialist i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
g ☐ Communications Analyst/Specialist i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
h ☐ Computer Graphics Analyst/Specialist i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
i ☐ Office Automation Analyst/Specialist i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐
j ☐ Other. Specify: _____	☐	☐	☐	☐	☐	☐
3 – Customer Support						
a ☐ Technical Support Representative i ☐ hardware ii ☐ software	☐	☐	☐	☐	☐	☐
b ☐ Marketing/Customer Services Representative	☐	☐	☐	☐	☐	☐
c ☐ Sales Representative	☐	☐	☐	☐	☐	☐
d ☐ Other. Specify: _____	☐	☐	☐	☐	☐	☐
4 – Technical Writing						
a ☐ Technical Writer i ☐ jr. ii ☐ int. iii ☐ Sr.	☐	☐	☐	☐	☐	☐

Type of Technical Writing

b ☐ User-oriented manuals   d ☐ Marketing literature   f ☐ Other. Specify: _____

c ☐ Technically-oriented manuals   e ☐ Training materials

B – OCCUPATIONAL CAPACITY AND ENVIRONMENT

	a Computer Operations	b Programming	c Analysis	d Customer Support	e Technical Writing
1 ☐ Project leadership	☐	☐	☐	☐	☐
2 ☐ Supervisory capacity	☐	☐	☐	☐	☐
3 ☐ Worked as part of team	☐	☐	☐	☐	☐
4 ☐ Worked independently	☐	☐	☐	☐	☐
5 ☐ Consulting/advisory role to team (quality assurance)	☐	☐	☐	☐	☐

C – SYSTEM ENVIRONMENT

1 ☐ Online
2 ☐ Real time
3 ☐ Time sharing
4 ☐ Batch
5 ☐ Data communications (not distributed)
6 ☐ Process control
7 ☐ Distributed processing
8 ☐ Other. Specify: _____

D – HARDWARE / SOFTWARE ENVIRONMENT

	1 MANUFACTURER(S)	2 MODEL NUMBER(S)	3 MAIN FRAME	4 MINI	5 MICRO	6 OPERATING SYSTEMS	7 TELEPROCESSING (TP) MONITORS	i Less than 6 months	ii 6 months to 1 year	iii 1-2 years	iv 2-5 years	v 5-10 years	vi More than 10 years
eg	IBM	370	√			DOS	CICS	☐	☐	☐	☑	☐	☐
a								☐	☐	☐	☐	☐	☐
b								☐	☐	☐	☐	☐	☐
c								☐	☐	☐	☐	☐	☐
d								☐	☐	☐	☐	☐	☐
e								☐	☐	☐	☐	☐	☐
f								☐	☐	☐	☐	☐	☐
g								☐	☐	☐	☐	☐	☐

E – PROGRAMMING LANGUAGE / PROGRAMMING UTILITIES (REPORT WRITERS, EDITORS & DEVELOPMENT TOOLS)

1 – Programming Language

a ☐ COBOL   d ☐ APL   g ☐ PASCAL

b ☐ FORTRAN   e ☐ PL 1   h ☐ BASIC

c ☐ RPG   f ☐ ASSEMBLER   i ☐ Other, Specify: _____

2 – Programming Utilities

a ☐ Mark IV   d ☐ TSO/SPF

b ☐ Datatrieve   e ☐ Panvalet

c ☐ Easytrieve   f ☐ Other, Specify: _____

F – DATA BASE MANAGEMENT SYSTEMS / TELEPROCESSING MONITORS

1 ☐ IDMS   5 ☐ ADABAS   9 ☐ TASKMASTER

2 ☐ DL/1   6 ☐ TOTAL   10 ☐ IMAGE

3 ☐ IMS DB/DC   7 ☐ DMS II   11 ☐ Other, Specify: _____

4 ☐ S2K (SYSTEM 2000)   8 ☐ CICS   _____

G – APPLICATION SUBJECT MATTER

1 ☐ Business Financial (general ledger, AP/AR, payroll, personnel, inventory control)

2 ☐ Insurance/Trust

3 ☐ Scientific

4 ☐ Engineering

5 ☐ Software/Hardware Research & Development

6 ☐ Process Control/Monitoring

7 ☐ Statistical

8 ☐ Modeling/Simulation

9 ☐ Property Management

10 ☐ Education Systems

11 ☐ Other, Specify: _____

H – GENERAL TECHNICAL EXPERIENCE

1 ☐ Maintenance of existing programs

2 ☐ Design of   a ☐ applications systems
   b ☐ data base
   c ☐ teleprocessing network systems

3 ☐ Use of structured   a ☐ programming techniques
   b ☐ design techniques
   c ☐ analysis techniques

4 ☐ Software-hardware evaluation/optimization

5 ☐ Implementation and/or conversion of systems

6 ☐ Conducted studies   a ☐ time/cost
   b ☐ feasibility
   c ☐ requirements

7 ☐ Training course development and teaching

8 ☐ Other, Specify: _____

I – MANAGEMENT / ADMINISTRATION

1 – Area(s) of Expertise

	i Less than 6 months	ii 6 months to 1 year	iii 1-2 years	iv 2-5 years	v 5-10 years	vi More than 10 years
a ☐ Management Information Systems/Data Processing Management	☐	☐	☐	☐	☐	☐
b ☐ Data Management (includes Data Administration & Data Base Management)	☐	☐	☐	☐	☐	☐
c ☐ Teleprocessing Network Management	☐	☐	☐	☐	☐	☐
d ☐ Systems Development Management	☐	☐	☐	☐	☐	☐
e ☐ Departmental Standards & Procedures Management	☐	☐	☐	☐	☐	☐
f ☐ Other, Specify: _____	☐	☐	☐	☐	☐	☐

2 – Management Functions

a ☐ Financial/Budget Administration

b ☐ Policy Planning and Development

c ☐ Program Planning, Evaluation and Administration

d ☐ Contract Negotiations

e ☐ Other, Specify: _____

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I LICENSES/CERTIFICATES/REGISTRATIONS

		Specify type	Specify date
A	|_| Coaching certification		
B	|_| Instructor's course		
C	|_| Registered Fitness Appraiser		
D	|_| Certified Fitness Appraiser		
E	|_| Exercise Specialist		
F	|_| Other, specify: _____		

II FIRST AID/C.P.R.

A |_| First Aid Certificate, specify type: _____

B |_| C.P.R., specify type: _____

III OCCUPATIONAL INFORMATION

A INSTRUCTING/TEACHING/LEADERSHIP EXPERIENCE

1 Physical Activities

		i -1 yr	ii 1-3 yrs	iii 3-5 yrs
a	Fitness	|_|	|_|	|_|
b	Dance or movement	|_|	|_|	|_|
c	Aquatics	|_|	|_|	|_|
d	Gymnastics	|_|	|_|	|_|
e	Low organized games	|_|	|_|	|_|
f	Alpine skiing	|_|	|_|	|_|
g	Cross-country skiing	|_|	|_|	|_|
h	Boating	|_|	|_|	|_|
i	Canoeing	|_|	|_|	|_|
j	Sailing	|_|	|_|	|_|
k	Water-skiing	|_|	|_|	|_|
l	Windsurfing	|_|	|_|	|_|
m	Individual sports, specify:_____	|_|	|_|	|_|
n	Team sports, specify:_____	|_|	|_|	|_|

  aa |_| Coach

  bb |_| Referee

 o Other, specify:_____ |_| |_| |_|

2 Nature Activities

a |_| Nature interpretation

b |_| Nature games and crafts

c |_| Orienteering and survival skills

d |_| Backpacking, etc., specify:_____

e |_| Camping

f |_| Other, specify:_____

3 Cultural Activities/Adult Education

a |_| Fine arts (e.g., painting, sculpture)

b |_| Arts and crafts

c |_| Drama, puppetry

d |_| Music - Vocal

e |_| Music - Instrumental, specify:_____

f |_| Other, specify:_____

4 Club and Social Activities

a |_| Special events (e.g., excursions, entertainment events, seasonal programs)

b |_| Clubs

c |_| Other, specify:_____

B VOLUNTEER EXPERIENCE

1 Specify type and length of experience: _____

_____

_____

_____

C EXPERIENCE WITH SPECIAL GROUPS

		a Specialized experience
1	|_| General (all ages)	|_|
2	|_| Family	|_|
3	|_| Pre-school	|_|
4	|_| Children	|_|
5	|_| Teens	|_|
6	|_| Adults	|_|
7	|_| Seniors	|_|
8	|_| Geriatrics	|_|
9	|_| Physically disabled	|_|
10	|_| Mentally disabled	|_|
11	|_| Socially disadvantaged (i.e., low income)	|_|
12	|_| Inmates	|_|
13	|_| Addicts, specify type:	|_|

14 |_| Other, specify: _____

D SUPERVISION

1 |_| Supervisory Experience

a |_| Professional staff

b |_| Volunteer staff

c |_| Other, specify: _____

1 Administration and Management

	i -1 yr	ii 1-2 yrs	iii 2-3 yrs	iv 3-5 yrs	v +5 yrs
a |__| General supervision facility, staff and programs	|_|	|_|	|_|	|_|	|_|
b |__| Scheduling facility programs and staff	|_|	|_|	|_|	|_|	|_|
c |__| Planning and conducting facility feasibility studies	|_|	|_|	|_|	|_|	|_|
d |__| Planning and evaluating recreation/sports programs	|_|	|_|	|_|	|_|	|_|
e |__| Recruitment and selection	|_|	|_|	|_|	|_|	|_|
f |__| Training and development (paid staff and volunteers)	|_|	|_|	|_|	|_|	|_|
g |__| Advising on technical and professional matters	|_|	|_|	|_|	|_|	|_|
h |__| Policy, planning and development	|_|	|_|	|_|	|_|	|_|
i |__| Other, specify: _____	|_|	|_|	|_|	|_|	|_|

2 Finance

a \|__\| Purchasing

b \|__\| Fund raising

c \|__\| Budgeting responsibility

   i \|__\| under $500,000, specify largest: _____

   ii \|__\| $500,000 - $2 million, specify largest: _____

   iii \|__\| over $2 million, specify largest: _____

d \|__\| Government funding (e.g., applying for grants)

e \|__\| Other financial experience, specify: _____

3 Public Relations

a \|__\| Handling requests, enquiries and complaints

b \|__\| Community animation or development

c \|__\| Public speaking

d \|__\| Publicity activities

   i \|__\| Preparing brochures, posters etc.

   ii \|__\| Writing newsletters or news releases

   iii \|__\| Media interviews (radio, television or newspaper)

e \|__\| Other public relations, specify: _____

F OCCUPATIONAL TITLES

	a -1 yr	b 1-2 yrs	c 2-3 yrs	d 3-5 yrs	e +5 yrs
1 Executive Director/General Manager/Director	|_|	|_|	|_|	|_|	|_|
2 Program Director	|_|	|_|	|_|	|_|	|_|
3 Physical Education Director	|_|	|_|	|_|	|_|	|_|
4 Recreational Therapist	|_|	|_|	|_|	|_|	|_|
5 Camp Counsellor	|_|	|_|	|_|	|_|	|_|
6 Camp Director	|_|	|_|	|_|	|_|	|_|
7 Other, specify: _____	|_|	|_|	|_|	|_|	|_|

IV TYPES OF ESTABLISHMENTS/WORK LOCATIONS

A \|__\| Camp

B \|__\| Community centre

C \|__\| Correctional institution

D \|__\| Educational institution

E \|__\| Fitness centre

F \|__\| Hospital

G \|__\| Other health care facility/clinic

H \|__\| Private club

I \|__\| YMCA, YWCA, YMHA, YWHA

J \|__\| Other, specify: _____

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WELDING

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1-2
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A — OCCUPATIONAL TITLES

		a Less than 6 months	b 6 months to 1 year	c 1-2 years	d 2-5 years	e More than 5 years
1	☐ Welding Machine Operator	☐	☐	☐	☐	☐
2	☐ Apprentice Welder	☐	☐	☐	☐	☐
3	☐ Welder	☐	☐	☐	☐	☐
4	☐ Welder-Fitter	☐	☐	☐	☐	☐
5	☐ Tool Room Welder	☐	☐	☐	☐	☐
6	☐ Lead Hand	☐	☐	☐	☐	☐
7	☐ Supervisor	☐	☐	☐	☐	☐
8	☐ Other job titles, specify: _____	☐	☐	☐	☐	☐

B — WELDING PROCESSES

1 — Manual and Semi-Automatic Processes

		i Less than 6 months	ii 6 months to 1 year	iii 1-2 years	iv 2-5 years	v More than 5 years
a	☐ Resistance Welding, Spot or Seam	☐	☐	☐	☐	☐
b	☐ Oxygen-fuel Welding (Oxy-acetylene or other)	☐	☐	☐	☐	☐
c	☐ Shielded Metal Arc, SMAW (Stick or arc welding)	☐	☐	☐	☐	☐
d	☐ Gas Tungsten Arc, GTAW (TIG)	☐	☐	☐	☐	☐
e	☐ Gas Metal Arc, GMAW (MIG)	☐	☐	☐	☐	☐
f	☐ Flux Cored Arc, FAW (With or without gas shield)	☐	☐	☐	☐	☐
g	☐ Plasma Arc Welding, PAW	☐	☐	☐	☐	☐
h	☐ Submerged Arc Welding, SAW	☐	☐	☐	☐	☐
i	☐ Other processes, specify: _____	☐	☐	☐	☐	☐

2 — Specify above processes used most often.

_____

_____

3 — Fully Automatic Welding Processes

a — Specify type.

_____

b ☐ Have you set-up automatic welding machines?

C — SOLDERING AND BRAZING

		a Less than 6 months	b 6 months to 1 year	c 1-2 years	d 2-5 years	e More than 5 years
1	☐ Hand Soldering	☐	☐	☐	☐	☐
2	☐ Soldering Machine Operation on Assembly Line	☐	☐	☐	☐	☐
3	☐ Torch Brazing	☐	☐	☐	☐	☐
4	☐ Other brazing, e.g. furnace brazing (Specify type): _____	☐	☐	☐	☐	☐

_____

D — TYPES OF WORK DONE

1 ☐ Factory Assembly — Making the same welds on many assemblies

2 ☐ Custom Fabrication — Most welds and work pieces different

3 ☐ Automobile or Truck Repair

4 ☐ Machinery or Equipment Repair

5 ☐ Repairing Cast Iron or Cast Steel

6 ☐ Shipbuilding or Ship Repair

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7 ☐ Aerospace Welding

8 ☐ Pressure Vessel or Piping Manufacturing or Installation

9 ☐ Pressure Vessel or Piping Repair

10 ☐ Construction of Main Transmission Pipelines

11 ☐ Construction of Local Distribution or Service Pipelines

12 ☐ Structural Welding in Construction

13 ☐ Other, specify: _____
_____

E — WELDING POSITIONS

1 ☐ Flat

2 ☐ Horizontal

3 ☐ Vertical-Up

4 ☐ Vertical-Down

5 ☐ Overhead

6 ☐ All positions

F — OTHER OPERATIONS (CHECK THOSE IN WHICH YOU HAVE AT LEAST 6 MONTHS EXPERIENCE)

1 ☐ Read and Interpret Blueprints

2 ☐ Read Weld or Process Specifications

3 ☐ Layout or Chalk Shapes on Sheet or Plate Metal

4 ☐ Cut Shapes Manually Using – Gas Torch

5 ☐ Cut Shapes Manually Using – Plasma or Carbon Arc Cutting Tools

6 ☐ Use Semi-automatic or Automatic Flame or Arc Cutting Machines

7 ☐ Operate Sawing Machines

8 ☐ Operate Powered Bending Brakes

9 ☐ Operate Powered Shears

10 ☐ Operate Pipe Cutting or Bevelling Machines

11 ☐ Use Measuring Instruments to Fit Work Pieces

12 ☐ Rig Large Work Pieces or Operate Hoists

13 ☐ Torch Straighten Metal

14 ☐ Use Dye Penetrant or Magnetic Particle Non-destructive Testing Equipment

15 ☐ Other, specify: _____
_____

G — METALS USED

1 ☐ Stainless Steels

2 ☐ Aluminum and Alloys

3 ☐ Magnesium and Alloys

4 ☐ Nickel and Alloys

5 ☐ Titanium

6 ☐ Zirconium

IV – LICENSES / CERTIFICATES OF QUALIFICATION

NAME	CLASS
a _____	_____
b _____	_____
c _____	_____
d _____	_____