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THE DETERMINANTS OF SUCCESSFUL SCHOOL-TO-WORK TRANSITIONS AND THEIR IMPACT ON LABOR MARKET OUTCOMES

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ABSTRACT

Notwithstanding the astonishing growth in college enrollments, high school remains important to workforce entry. This fact is often buried by pronouncements about the primacy of U.S. higher education—in 2005, for example, 69% of high school graduates went on to college. In the meantime, a restructured economy has replaced unemployment with a form of disguised unemployment or nonstandard type of work, manifested as an underutilization of the labor force via part-time and low-pay work. Traditional employment indicators do not adequately portray the current school-to-work transition for young adults.

This study's purpose was to investigate the school-to-labor market transition of high school educated workers, using job-education match as an alternative to traditional employment indicators. To address this issue, support, awareness, and skills were examined as elements of an important framework for a successful transition. As for outcome variables, this study considered job-education match and wage rate differential within-group. Family background, school experience, and work readiness were incorporated as potential predictors, with training credentials and demographic characteristics (e.g., work experience, gender, and race) controlled. This study targeted work-bound high school students only, who had never enrolled in school for further study three to six years after high school graduation. The data source was the NLSY 97. Analyses were conducted on two dimensions: cross-sectional and longitudinal.

While there were some discrepancies between the cross-sectional study and growth model, overall this study demonstrated several results. As work experience accumulated, young workers found jobs appropriate to their education level; on average, 85% of workers held jobs that matched their education level six years after high school graduation. The effects of a training certificate on job-education match demonstrated that a lack of experience during high school could be mitigated by efforts made after entering the labor market. The initial status of the job-education match depended on several indicators: parents' education level, courses of study in high school, participation in school-to-work programs, and self-esteem. The speed of the job-education match was changeable and conditional on tech-prep and mentoring programs. Analyses of log hourly wage rates showed that these rates had a linear, rather than a quadratic, relationship with work experience. Comprehensive course of study, cooperative programs, and employment in high school increased the average log hourly wage rates across work experiences during the periods considered in this research, i.e., up to six years after high school graduation. Inclusion of job-education match as a predictor for log hourly wage rates into a model changed the relationships between other predictors and log hourly wage rates. This was indicative of the mediating role of job-education match for those relationships. In addition, job-education match itself had a significant effect on log hourly wage rates and explained most of the variances in log hourly wage rates within and between individuals

Against prevailing notions of vocational education, this study may provide minimal support for high schools' role in preparing students for future jobs; that is, the manifested purpose of vocational education—labor market advantage—can be facilitated by experience in high school. Study findings imply that it is worthwhile to make vocational programs approachable to students in high school.

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Chapter 1

Introduction

1.1 Background

Notwithstanding the astonishing growth in college enrollments, high school remains important to workforce entry (Kerckhoff, 2000; Rosenbaum, 2001). This fact is often buried by pronouncements about the primacy of U.S. higher education—in 2005, for example, 69% of high school graduates went on to college (U.S. Department of Labor, 2006). However, it should be noted that almost 50% of all college students drop out of school (Diverse, 2007). The share of workers with only a high school diploma or less above age 25 in the U.S. workforce was above 57% in 2005 (U.S. Department of Labor, 2007a). Even so, researchers and the public think of high school as only a rite of passage toward college. Recent research focuses overwhelmingly on factors that enhance college enrollment and graduation (Rosenbaum, 2001; Rubinson & Hurst, 1997; Smith & Rojewski, 1993). Little research has examined the employment of students enrolled in vocational programs and their school-to-work transition. The few such extant studies have limited their research scopes to traditional economic outcomes, such as employment and wages (Kerckhoff, 2000; Mane, 1999).

But with the U.S. economic upturn since 1992, traditional indicators no longer successfully depict the nature of the current school-to-work transition for young adults (Dooley & Prause, 2004). This inference is supported by youth unemployment rates for the past fifteen years. The unemployment rate for young adults aged 20–24 has been around 10% (see Figure 1.1), even though the unemployment rate for young adults increased temporarily after the terrorist attacks on September 11, 2001. Furthermore, the gap between the unemployment rate for adults and that for youths is not very large compared to that for other developed European countries (Machin & Vignoles, 2005).

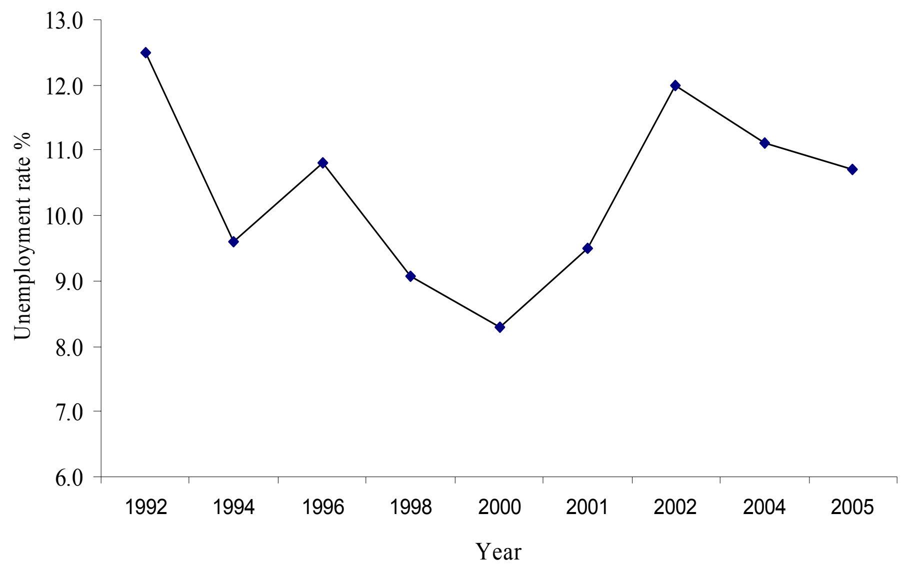

Figure 1.1. Youths' (ages 20–24, high school graduates) unemployment rate, 1992–2004. *Source*: National Center for Education Statistics (2005).

Instead, a restructured economy has replaced unemployment with a form of disguised unemployment or nonstandard type of work, manifested as an underutilization of the labor force via part-time and low-pay work (Kalleberg, Reskin, & Hudson, 2000; Kalleberg, 2000; Passmore, Mohamed, & Lin, 2002). Reflecting on these changing economic structures, some research studies have sought to re-categorize the employment index (Dooley & Prause, 2004; Jensen & Slack, 2003). The previous literature on underemployment conceptualized labor utilization based on wage rates and number of work hours.

Getting a good job has always been a top priority for students (Gray & Herr, 1998; Grubb & Lazerson, 2004; Neumark, 2007; Rosenbaum, 2001). So far, pay has been considered the single most important determinant in defining a good job (Green, 2006; Jencks, Perman, & Raingwater, 1988; Kalleberg, Reskin, & Hudson, 2000). Along with pay, sociologists who have sought to define human value in maximizing labor market productivity, have emphasized the utilization of skills in assessing job quality as an indicator of labor market success (Green, 2006). However, the literature on underemployment excludes the discrepancy between workers' attained education and education required by the workplace. Consequently, little is known about credential matches for young adults currently entering the labor market with a high school diploma.

Family and school are well known as the key contexts for career development in adolescence (Guay, Ratelle, Senécal, Larose, & Deschênes, 2006; Niles & Harris-Bowlsbey, 2005; Ng & Feldman, 2007). The focal point in developing a career lies in the partnership between the two as they work to make children aware of and exploring their future career. Unfortunately, society does not always provide meaningful experiences to high school students facing the labor force (Gray & Herr, 1998; Grubb & Lazerson, 2004; Neumark, 2007; Rosenbaum, 2001). Developing learning strategies that move students towards college are often viewed as a quick fix, but so far they seem to be just an excuse to turn away from the challenges faced by high school graduates in the labor market (Livingstone, 1998). An examination of the potential variations in experiences linked to transitions into entry-level employment is thus worthwhile, given the importance of a successful transition into the workplace.

1.2 Purpose of this Study

The purpose of this study was to address questions about the relationships among school-to-work transition-related variables and job-education fit and wage rates. The objective was to describe the school-to-work transition and investigate the relationships among transition-related characteristics of workers during high school by using two criteria to judge labor market success: labor utilization and pay.

1.3 Significance of this Study

So far, previous research on high school students has failed to take into account educational matches in the school-to-work transition. Most research on this transition has focused on identifying factors related to college enrollment or completion. Likewise, the dichotomous approach followed in examining workers' educational background, such as a review of the credentials of college- vs. noncollege-educated workers or skilled- vs. unskilled-workers, does not include the role played by high schools in preparing students for work (Arum & Shavit, 1995). These types of approaches increasingly divert public attention from thinking about high schools' role in transitioning students to the work world and maintain the belief that high school-educated workers are unskilled (Gray & Herr, 2000; Grubb & Lazerson, 2004).

Previous research on the job-education mismatch has been conducted on the premise that the discrepancy is due to an oversupply for higher-educated workers (Clogg & Shockey, 1984; Dooley & Prause, 2004; Freeman, 1976; Groot & van den Brink, 2000; Livingstone, 1998; Rumberger, 1981). Other characteristics of workers were not considered. Likewise, even though research on students' experiences as revealed in a review of curricula and part-time work during high school draws vastly different conclusions about the effects of college completion (Marsh & Kleitman, 2005), few studies have been conducted on how those experiences have affected the education-work match. Similarly, work readiness with respect to both cognitive ability and noncognitive behavior—even though the importance of the latter has already been stressed by employers (Conrad & Lehigh, 1999)—has received little attention as a source of education-work matches. In addressing those untouched questions, this study sought to identify how workers' characteristics prior to workplace entry relate to the subsequent job-education match. Above all, this study attempted to ascertain whether the job-education mismatch is due to workers' characteristics, such as lack of skill or abilities, or to the lower-level occupations held by mismatched workers lead them to underutilize their skills.

Much research on wage inequality has been conducted focusing on between-group inequality, especially the wage gap between college- and noncollege-educated workers (Acemoglu, 2002; Katz & Autor, 1999). Within-group inequality, the wage gap among workers who have similar labor market demographic profiles on indicators such as education level and age has not received much attention, despite the growth in wage inequality (McCall, 2000). Even though much research indicates that the widening wage gap in the U.S. is due to younger, less educated workers (DiNardo & Lemieux, 1996; Levy & Murnane, 1992; McCall, 2000), few studies have been conducted on wage inequality among high school-educated workers because many researchers consider low-wage entry-level jobs held by young adults to be a threshold for more decent jobs (Scherer, 2004). Furthermore, with the widening gap between college- and noncollege-educated workers, the fact that even 16–20% of college-educated workers earn less than those with high school diplomas, even after controlling for age, increases the need for comprehensive and systematic research on wage dispersion among high school-educated workers (U.S. Department of Labor, 1998; Deere, 2001). This study incorporated more specific variables targeting young adults in order to search for sources of within-group inequality arising from their high school experience, work skill readiness and family background as these deviate from previous broadly defined concepts such as technology and deunionzation. Contrary to previous research which focused on trends or changes in wage inequality, this study sought to identify the sources of inequality, and to learn how life experiences, learning in school, and family background affect the economic outcomes of high school-educated workers.

1.4 Problems and Research Questions

The literature shows that with increased access to college, young adults have become more ambitious about their education and future jobs and therefore delay establishing a vocational identity and engaging in occupational decision-making. This often means that their ambitions are not aligned with career development efforts (Schneider & Stevenson, 1999). Furthermore, high school emphasizes students' college attendance. The literature shows that high school counselors feel no responsibility for students' career guidance and do not possess proper knowledge about employment tracks (Rosenbaum, 2001). Taken together, such problems exacerbate the opportunities for educational mismatch among high school graduates (Gray, 2007). High schools' negligence in preparing students for their vocational identity (Lopez, 1989) leads students to depend on resources and information from their family. Therefore, those students who lack resources and family support may encounter some barriers in integrating their vocational identity. Thus, family background may play a key role in placing students in jobs that are equivalent to their education level. It has been shown that providing high school students with opportunities or motivations to explore future work roles leads them to organize their activities and dedicate their energy to developing a vocational identity (NG & Feldman, 2007). Clearly, then, having a part-time job or taking vocational programs may help students identify their vocational directions and goals and familiarize them with work values (Mortimer, 2003). The old saying that experience is the best teacher may apply to current high school students. The advantages from such experiences may give students a scaffold at an entry-level job in the future labor market and enable a better match between job and education (Stern, McMillion, Hopkins, & Stone, 1990). Research has often demonstrated that workers' performance is closely related to the skills with which they are equipped. In this respect, mismatched workers may lag behind matched workers in skill endowments (Robst, 1995). Meanwhile, a recent study has shown that employers do not use high school grades as a criterion in hiring high school graduates, but typically place more value on non-cognitive behaviors (Farkas, 2003; Moss & Tilly, 2001). Furthermore, not only have many employers pointed out current high school-educated workers' lack of non-cognitive skills, but have also admitted that they do not provide training in non-cognitive skills and do not know how to train their employees (Murnane, Willett, & Levy, 1995; Rosenbaum, 2001). Therefore, differences among workers in cognitive skills and noncognitive behaviors may have an impact on the extent of labor utilization. Taken together, the specific research question asked in this study was as follows:

1. To what extent are transition-related variables such as family background, parental supportiveness, high school curriculum, part-time work in high school, cognitive ability and noncognitive behavior associated with the successful school-to-work transition of high school-graduated workers with respect to educational match?

Meanwhile, the growing wage inequality in the U.S. is a major concern. Research has indicated that within-group inequality accounts for most of the growth in wage inequality (Acemoglu, 2002). The growing demands for skills, deunionization, and workplace relocation, which are caused by globalization, have been some extensively researched in relation to growth in wage inequality. According to McCall (2000), these explanations can be applied to between-group wage inequality but cannot account for within-group wage inequality, i.e., growing wage inequality among high school graduates. Thus, this study examined how experience at the time of high school influences wage differentials. Further, the impact of transition-related variables—family background, career exploration opportunity during high school, and work skill readiness—was explored to learn more about wage differentials among high school-educated workers. Meanwhile, literature on educational mismatch suggested that surplus schooling was rewarded less than fully utilized schooling in the sense that schooling in excess of that required by a job was underutilized. This study investigated whether and how this relationship could apply to wage inequality with high school-educated workers. The specific questions for this issue were as follows:

2. To what extent are transition-related variables such as family background, parental supportiveness, high school curriculum, part-time work in high school, cognitive ability and noncognitive behavior associated with the within-group wage rate differential?
3. What is the relationship between educational mismatch and wage rates for high school-educated workers?

Some research has shown that early negative job experiences can influence youths' efforts to seek opportunities to move upward (e.g., Sicherman, 1991), while other studies (e.g., Scherer, 2004) have suggested that early negative job experiences have a permanent negative effect. Thus, this study examined how relationships observed in research conducted to answer Questions Two and Three have changed over time.

4. How does the relationship among transition-related variables and wage rates and job-education mismatch change over time?

1.5 Definitions of Concepts

1.5.1 Job-Education Match

The required education for jobs is matched against the attained education of workers. This study conceptualized getting a good job or a successful transition from school-to-work as having a job that fully utilizes one's education. This is because the backbone of a successful transition from school-to-work could be to fully utilize the education that a young adult attained in school. As the underemployment framework is combined with the school-to-work-transition, the criterion for successful transition can be whether or not workers match their attained education with required education in the workplace.

1.5.2 Within-Group Wage Rate Differentials, or Inequality

Within-group wage rate differentials are referred to as the wage rate difference among individual workers who have similar human capital endowments, such as education and work experience (Levy & Murnane, 1992). Because this study targeted high school-graduated workers, wage rate differentials in this study automatically mean within-group wage rate inequality.

1.5.3 Transition-related Variables

These imply support, career exploration, and skills that enable adolescents to easily transition into the work world. This study incorporated family background, parental supportiveness, high school curriculum, part-time work in high school, cognitive ability and noncognitive behavior into this concept.

1.5.4 Socio-economic Status (SES)

This refers to parent's education level.

1.5.5 Parental Support

This is the respondents' response to questions about whether they felt that their parents were supportive of them.

1.5.6 High School Curriculum

This refers to two things: course of study and school-based work program. The course of study respondents took in high school was measured with five different responses: general program, college preparatory, vocational and technical, comprehensive course of academic and vocational program, and other. School-based work programs are composed of seven different types of programs: career major, cooperative education, internship/apprenticeship, job shadowing, mentoring, school-based enterprise, and Tech-Prep. See Table 3.3 for a more specific explanation.

1.5.7 Work Experience during High School

This refers to an employee-employer relationship, and specifically to whether respondents were involved in an ongoing relationship with an employer.

1.5.8 Cognitive Ability

Cognitive ability is defined as ‘the capacity to solve intellectual problems’ (Carbonaro, 2005, p. 166). This study defined it as the respondents’ score on arithmetic reasoning in four areas of the Armed-Services Vocational Aptitude Battery (ASVAB): (a) arithmetic reasoning, (b) mathematical knowledge, (c) word knowledge, and (d) paragraph comprehension.

1.5.9 Work-related Behavior (Noncognitive Ability)

This refers to a productive behavior (Farkas, 2003). This study defined it as a score on the self-esteem subscale.

1.6 Conceptual Framework

As shown in Figure 1.2, the framework used in examining the main process followed by high school students in moving successfully into the work world was guided by the work of Baker and Cerler, Jr. (2004). In their book, developmental needs and tasks for the transition to work are categorized into “support, awareness, and skills” (p. 228). Students who have support from parents, peers, and others engage in better decision making about jobs and have better information about them. Being aware of the nature of a specific type of job enables students to plan for those jobs and arrange their experiences and activities around their goal. Students who prepare themselves with skills, knowledge, and proper behavior for jobs have better opportunities to successfully transition to work. This study assumed that those factors would affect the extent to which workers made use of their educational attainment in the workplace. In order to control for human capital formation after high school graduation, work experience and possession of a training certificate were incorporated into the model. According to the overeducation and underemployment literature, the degree to which education attained is matched with education required affects wages (Rumberger, 1981). This study, which is based on findings from well-known research that education and work as well as family background are key components of the social stratification process, considered the impact of specific variables related to the school-to-work transition on wage rate inequality (Blau & Duncan, 1967).

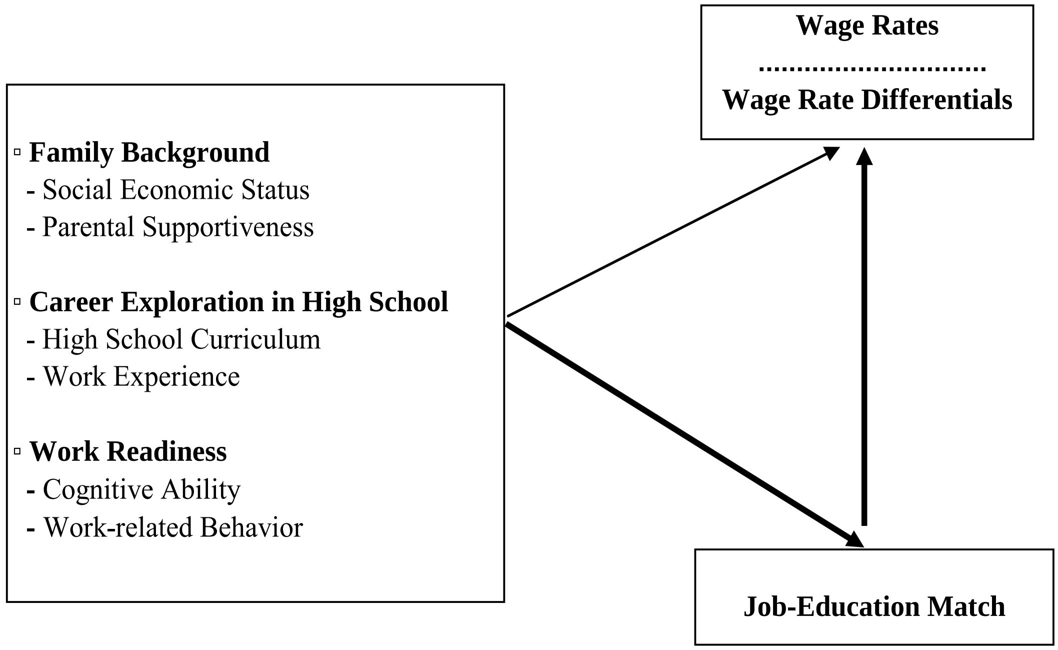

Figure 1.2 Conceptual framework: Youths' transition from school-to-work and its impact on labor market outcomes

Chapter 2

Literature Review

This study targeted high school-educated workers only. The purpose of this study was to identify determinants of successful transitions from school to an entry-level job commensurate to or matched with workers' educational attainment, to investigate the relationship between determinants and wage rates, and to examine the association between education-job match and wage rates. Addressing this question, this study focused on transition-related variables in terms of developmental needs such as support, awareness, and skills. Also, this study incorporated family background into the analysis, reflecting on the undeniable influence of family background on social status acquisition. Furthermore, this study investigated how workers' job-seeking methods and occupation changes affect the utilization of workers' characteristics.

This literature review is organized around the following sections: (a) theoretical framework of the school-to-work transition, (b) labor market outcomes, (c) job-education mismatch and within-group wage inequality, (d) transition-related variables—family's socioeconomic status, family support, high school curriculum, work experience in high school, cognitive ability, and noncognitive behavior, and (e) other control variables.

2.1 Theoretical Framework of School-to-Work Transition

It has been observed in the labor market that persons with the same schooling receive different wage rates and hold lower-level jobs compared to others with the same work experience. There is less agreement about the reasons for this observed relationship among theories. Some reasons cited include lack of skills or abilities of persons concerned, job position held by persons concerned, and lack of information on job and persons' characteristics.

According to human capital investment theory, the centrality of difference in wages and job status lies in individual differences in skills, knowledge, and behavior (Farkas et al., 1997). The relationship between human capital investments such as education, job training and wages results from unobservable intervening variables, such as skill and productivity (Becker, 1993; Schultz, 1971).

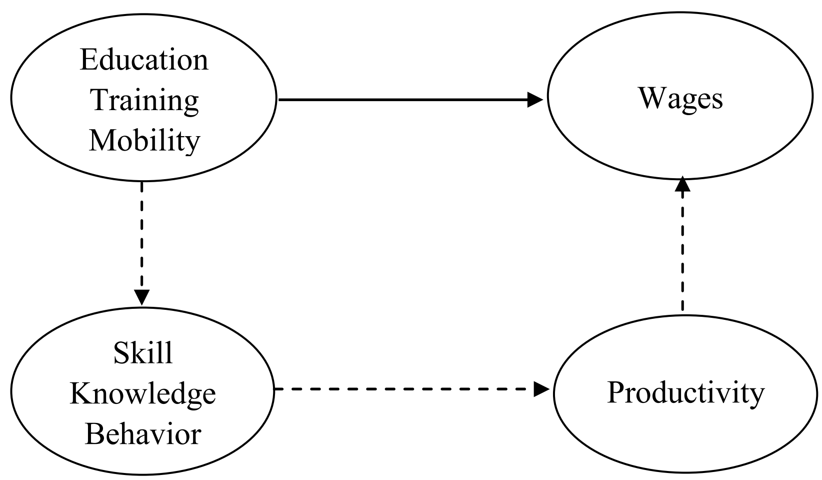

Figure 2.1 Explanation by human capital theory.

Note. Solid line is the observed path. Dotted lines are the manipulated path.

As shown in Figure 2.1, education enhances a worker's skill, knowledge, and behavior to "acquire and decode information about cost and productive characteristics of other inputs or adapt to technological change" (Welch, 1970, p. 42). If some workers receive lower wages than their coworkers with the same schooling, this reflects a difference in human capital endowments for those workers. From this perspective, studies have examined how individual ability, including cognitive ability and recently noncognitive behavior, influences labor market outcomes (Farkas et al., 1997; Heckman et al., 2006; Jencks, 1979; Murnane, Willet, & Levy, 1995; Raudenbush & Kasim, 1998).

A job competition model developed by Thurow (1975) challenges the notion that education raises individual productivity. Wages are fixed by collective bargaining and productivity and earnings are associated with jobs, not individual workers (van Ours & Ridder, 1995). Individuals are allocated to available jobs based on background information, such as education, sex, and age, which is reflected in the cost of training skills necessary to perform jobs (Thurow, 1975). According to the job competition model, in order to stand at the front of the queue in the labor market, students pursue higher credentials (Rubinson & Hurst, 1997). This causes an oversupply of highly educated potential workers; those workers who do not obtain jobs consummate with their education level crowd out relatively less-educated workers to lower-level jobs. That is, the mismatched workers with a college-level education trigger a chain reaction in lower-level jobs, even equal to and less than high school-level jobs. In this model, on which many studies (Groot & Maassen van den Brink, 2000; Livingstone, 1998; Rumberger, 1981) of job-education mismatch are based, if some workers earn less money compared to other workers with similar background traits, they are employed in different jobs in which productivity is different.

2.2 Job-Education Mismatch

In the literature, diverse terms are used to describe job-education mismatch: *overinvestment* (Freeman, 1976), *overeducation* (Rumberger, 1981), *underemployment* (Clogg & Shockey, 1984; Dooley & Prause, 2004), *occupational mismatch* (Smith, 1986), and *education-job gap and credential mismatch* (Livingstone, 1998). However, the common term is based on the underutilization of educationally developed skills in the labor market (Groot & van den Brink, 2000; Rumberger, 1987). This study used the term *job-education mismatch* because it can be solved for by successfully performing developmental tasks in school and at home. Job-education mismatch exists for those individuals in the workforce who are employed in jobs that do not make full use of their education (Clogg & Shockey, 1984). That is, mismatched workers are employed in jobs requiring less education. This definition is derived from two notions (Rumberger, 1981): first, every job in the labor market requires “a minimum set of worker characteristics” (p. 15) such as skill, ability and attributes; and second, workers primarily “acquire general skills and abilities from schools” (p. 15). Therefore, the job-education match is judged by “contrasting the skill requirements of jobs and skill attainments of workers” (Rumberger, 1981, p. 45). This definition requires that the skill requirements of jobs be determined, but it is difficult to differentiate between general skill and specific skill in job requirements (Becker, 1993).

Literatures on job mobility suggest that job turnover for mismatched workers can be a mechanism that enables personal traits to fit into job characteristics (Sicherman & Galor, 1990). Robst (1995) showed that the mismatched workers voluntarily quit jobs to gain a better fit. However, turnover itself does not necessarily lead to a better fit; the mismatched worker may gain a fit between education and job, or the matched worker may lose a match by changing jobs. This is because job turnover due to layoffs may lead employers to judge an employee’s job performance and productivity. Thus, job turnover serves as a screening device for employers (Rosenbaum, 2001).

As for the impact of job-education mismatch on wages, Rumberger (1987) suggested that mismatched schooling is rewarded less than fully utilized schooling, in the sense that schooling in excess of that required by a job is underutilized. Chevalier (2001) demonstrated that "mismatched workers suffer from a pay penalty" (p. 2), compared to workers with appropriate education in a matched job. Matched workers can earn more than mismatched workers with the same schooling because the former are more productive than the latter (Sicherman, 1991).

2.3 Within-Group Wage Inequality

Contrary to Kuznet's belief that economic growth will decrease inequality in society, the U.S. has experienced rising wage inequality since 1979 (Svizzero & Tisdell, 2003). Within-group wage inequality explains more than half of the rising wage inequality in the U.S. (Acemoglu, 2002; Katz & Autor, 1999; U.S. Council of Economic Advisors, 1998). However, not much attention has been given to within-group wage inequality compared to between-group inequality (McCall, 2000). Within-group wage inequality is referred to as the wage difference among individual workers who have similar human capital endowments, such as education and work experience (Levy & Murnane, 1992). Accordingly, it is commonly measured by residual standard deviation, or dispersion in residual, which is the leftover of wage estimates using the Mincer wage regression, including education and work experience (Lemieux, 2003; McCall, 2000).

Sources of rising within-group wage inequality are diverse and have been divided into two types: demand-side factors and supply-side factors. Discussed demand-side determinants are as follows (Levy & Murnane, 1992; McCall, 2000): skill-biased technology change (Levy & Murnane, 1992), minimum-wage setting policy (Blau & Kahn, 1996), and workers' movement from the manufacturing industry to the service industry (Levy & Murnane, 1992; Schrammel, 1998). These three sources share a characteristic: they all stem from increasing elasticity in demands for low-skilled workers (McCall, 2000). As for the influence of technology, Juhn, Murphy, and Pierce (1993) suggested that technological change favors skilled workers, leading to an increase in unobservable skill demands. Bowles and Gintis (2001) noted that noncognitive behavior is one of those unobservable skills.

Looking at wages, Blau and Kahn (1996) focused on localization in the governance of minimum-wage settings, in which authority is transferred to the state government. Levy and Murnane (1992) and Schrammel (1998) saw a labor shift from manufacturing jobs to service jobs as an important explanation for rising within-group inequality. They suggested that growing wage inequality was due to the mobility of workers employed in the manufacturing industry, where employment is characterized by low residual variation in wages, to the service industry, where residual dispersion in wages is high. However, McCall (2000) asserted that increasing flexibility in the labor market for nonstandard employment over technology employment has changed the industrial mix.

As for the supply-side determinants of within-group wage dispersion, previous studies have pointed to the immigration of low-skilled workers and differences in individual abilities (Svizzero & Tisdell, 2003; Taylor, 2006). The massive supply of low-skilled immigrant workers and female workers suppress the wages of low-skilled workers and lead to wage dispersion among low-skilled non-college workers (Taylor, 2006).

Svizzero and Tisdell (2003) asserted that the universal attainment of a high school education has resulted in a reward system that is based on an individual's cognitive ability and that individual differences in ability intersect with adaptability to new technology.

2.4 Family's Socioeconomic Status

A family's socioeconomic status permeates life through the social selection and allocation process (Farkas, 2003). To some extent, an individual's current status is embedded in family background. Blau and Duncan's job status model (1967), which has been a dominant influence on subsequent research regarding family background, suggested that family socioeconomic status exerts a significant influence on children's job status directly and indirectly through schooling. Among family background factors, parental educational level is known as the most powerful predictor of children's job value and career development (Halaby, 2003; Mortimer et al., 1992). Erikson and Jonsson's research (1996) suggested that there is an information divide on return for a certain level of education between parents who completed their education and those who did not. That is, parents who completed high school fared better than those who did not in preparing their high school-educated children for future occupations by transmitting better information to their children (Van de Werfhorst & Andersen, 2005). Mortimer et al's research (1992) found that adolescents from below the poverty threshold had a low level of economic self-efficacy, i.e., they felt less likely to have a good job and good pay in the future. Likewise, adolescents from economically challenged families tended to have difficulty developing a career identity because parental expectation interferes in setting up their own career objectives (Penick & Jepsen, 1992). This can lead adolescents to make uninformed and hasty decisions to escape from this situation (Fisher & Griggs, 1994).

As for the effect of family background on wages and job status, research (Farkas et al., 1997; Rosenbaum, 2001) has concluded that a family's socioeconomic status has little influence on the early jobs of non-college graduates. Rosenbaum (2001) listed it as the reason that a youth's employment is random and that employers continue to follow a matching process when seeking the proper employees. That is, it is too early for structural factors to serve as a determinant of social stratification. On the other hand, Warren, Sheridan, and Hauser (2002) estimated that family background has an effect on early job status at labor market entry indirectly through educational attainment. Also, they suggested that with increasing work experience, the family effect on job status disappears and is replaced by job performance or productivity.

2.5 Parental Supportiveness

The literature shows that the existence of significant others such as peers, teachers, and parents is beneficial to students in young adulthood as they establish an occupational direction (Bidwell & Plank, 2000). Above all, the children's relationship with their parents is the most influential and persistent effect on their career development (Whiston & Keller, 2004). Fisher and Griggs (1994) asserted that the career development of adolescents is more influenced by parental support than by parental education or job status. Penick and Jepsen (1992) suggested that the relationship between parents and children is related to how children line up their vocational identity. Phillips et al. (2002)

also found that support from available adults enables adolescents to easily transition to the work world, but those who do not exhibit work readiness had a significant lack of adult support in their response. Blustein et al.'s research (1997) suggested that adolescents' attachment to their parents promotes their engagement in active explorations for their career and leads them to take risks in career exploration. Mortimer (1976) showed the gender difference in the effect of parental relationship on career development. She asserted that sons tended to select occupations similar to their father's and that this relationship was reinforced through the father-son relationship. However, little research has been conducted on how parental support influences labor market outcomes (Whiston & Keller, 2004).

2.6 High School Curriculum

Previous literature has conceptualized *developmental tasks* (Erickson, 1966) related to occupational awareness using diverse constructs such as *vocational identity* (Holland, Gottfredson, & Power, 1980; Lopez, 1989), *vocational development* (Mortimer et al., 1992), *career maturity* (Gray & Herr, 1998), *career self-efficacy* (Grabowski, Call, & Mortimer, 2001), and *readiness* (Philips, Blustein, Jobin-Davis, & White, 2002). All of these concepts refer to the salience of high school students' vision of their vocational interests and values when considering career planning (Lopez, 1989). Schneider and Stevenson (1999) specified how the misalignment of aspirations and preparation for future careers seriously influences the transition to work among high school students. Thus, high school students must and should explore their occupational interests and start to gather occupational information early on (Blustein, et al., 1997).

The high school curriculum is generally divided into three parts in the U.S.: general program, college preparatory program, and vocational and technical program. The vocational and technical program is composed of a career preparation curriculum designed to build a vocational identity in terms of participation, commitment, and value expectations (Ng & Feldman, 2007). Many studies (Brown, 2003; Gray & Wang, 1989; Griffith & Wade, 2001; Mane, 1999; Rosenbaum, 2002) have investigated whether the vocational and technical program pays off in the labor market compared to other programs such as college preparatory and general programs. Those studies are based on the rationale that a considerable number of college drop-outs who undertook a curriculum other than vocational and technical entered the labor market without adequate skills (Griffith & Wade, 2001). As for the benefits of a vocational and technical program, Griffith and Wade (2001) suggested that those who engaged in a vocational curriculum earned higher wages six years after graduation than those who did not and that those vocational graduates are less likely than non-vocational program graduates to be employed in nonstandard temporary jobs which require no or little preparation, such as low-paid service jobs. Mane's research (1999) on the outcome of vocational courses taken by three cohorts of graduates in 1972, 1980, and 1992, showed that returns to courses taken increased from 1972 to 1980 and 1992. Contrary to the above studies, Garddecki and Neumark (1998) suggested that the benefits of undertaking a vocational and technical program only apply in the short term. In the long run, the lack of general skills outpaces the endowment of specific skills compared to other program graduates. Bishop (1998) and Grubb and Lazerson (2004) contended that only when vocational program graduates get a job related to training in high school, do they receive benefits via employment and wages. However, only a few have training-related jobs.

Other important activities relating to high school students' work readiness involve school-to-work programs. The school-to-work programs initiated in 1994 by the School-to-Work-Opportunities Act (STWOA) were aimed at "increasing labor market skills and to guide young people into career paths with greater potential for growth of such skills" (Public Policy Institute of California, 2004, p. 1). Since the STWOA's passage in 1994, various types of programs have been offered to students: cooperative education, internship/apprenticeship, job shadowing, mentoring, school-based enterprise, and Tech-Prep (see Table 3.3 for a specific explanation). However, in 2001 the STWOA was not reauthorized, and thereafter the school-to-work programs were not funded by the federal government, with the responsibility for funding converted to each state (Neumark & Rothstein, 2006).

A few studies have analyzed the program's effect on employment. Neumark and Rothstein's research (2006) demonstrated that three types of programs, including cooperative education, internship, and apprenticeship, increased employment after high school graduation by 7–9%. Furthermore, internship and apprenticeship programs enhanced the employability of students from economically disadvantaged groups. Also, they estimated these programs were more beneficial to male students, who are below the median of probability for college attendance, and prevented them from floundering about aimlessly. Bragg's research (2001), which examined the effects of the Tech Prep program, suggested that this program provides an advantage in acquiring full-time employment.

However, Gardecki and Neumark (1998) and Grubb and Lazerson (2004) questioned whether early decisions about and concentration on a specific occupation, which was an aim of the STOWA, resulted in better long-term outcomes than the trial-and-error process engaged in to find the best job match. They demonstrated that early steady and stable jobs do not necessarily lead to better labor market outcomes in terms of wages and fringe benefits in one's late 20s.

2.7 Work Experience during High School

Part-time work is a common phenomenon among high school students in the U.S. but it is very rare in other countries (Larson & Verma, 1999). U.S. high school graduates seldom receive assistance from institutional links between schools and the workplace, unlike Germany and Japan (Mortimer, 2003; Rosenbaum, 2001), so it is a rational choice to combine school and work in a rapidly changing work world. Working in high school serves as an internship that increases the fit between self and occupation (Mortimer, 2003). With reference to this, some research has posited that such trends indicate low performance among U.S. students compared to those in international studies such as the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMMS) (Johnson & Lino, 2000). So far, the controversy about students' working during high school stems from whether such works distracts and disengages students from studying (Bills, 2004; Marsh & Kleitman, 2005).

Literature on this issue is inconsistent in terms of the impact of working on academic achievement. Marsh and Kleitman (2005) reviewed the previous research and organized it into three trends: negative, positive and compromising studies. Studies reporting negative effects of work are mainly based on Coleman's (1959) zero sum time allocation, i.e., students' working encroaches on time for academic work and means that less time is spent on studying (Warren, 2002). Steinberg and Dornbusch (1991) showed that, psychologically, employment during school disengages students from study. In addition to educational aspects, some studies (Marsh & Kleitman, 2005; Steel, 1991) have suggested that working in high school reduces occupational aspirations. Incidentally, positive studies have shown that in the U.S., with the lack of a link between high school and the workplace, work experience in school helps students to learn specific job-related skills, identify their vocational identity, and confirm the relevance of what they learned in school (Kerckhoff, 2000; Mortimer, 2003). These studies reflected on the effect of work from the viewpoint of the transition from school to work, but did not examine it empirically. The compromising studies reconciled for these negative and positive studies showed that the impact of work hours on academic achievement is not linear—i.e., not working and extreme work had negative consequences but concerted work combined with schooling increased academic outcomes (Staff & Mortimer, 2007). Also, there are gender differences. For male students, work experience is an alternative to schooling, whereas for female students, part-time work makes them more devoted to schooling (Steel, 1991).

However, there has been relatively little empirical examination of the wages for part-time employment and students' entry into the labor market. Studies have sought to link labor market outcomes to such unobservable factors as enhancing human capital from the work experience in high school (Mortimer, 2003). Steel (1991) suggested that the quantity and quality of work experience in high school were related to subsequent employability after high school. An Australian study (Vickers, Lamb, & Hinkley, 2003) showed that early work enhanced the odds of getting a full-time job. Ruhm (1997) showed that quadric terms of high school work hours only in the senior year were related to wage advantage ten years after high school.

2.8 Cognitive Ability

Cognitive ability is defined as “the capacity to solve intellectual problems” (Carbonaro, 2005, p. 166) and includes “literacy, numeracy, reasoning and problem solving, and knowledge” (Kingston, Hubbard, Lapp, Schroeder, & Wilson, 2003, p. 56). In the literature (Carbonaro, 2005; Farkas et al., 1997; Murnane, Willet, & Levy, 1995; Raudenbush & Kasim, 1998), the three R’s, i.e., reading, writing, and arithmetic ability, are usually used as a proxy for cognitive ability. It is those abilities that employers complain workers lack when they enter the labor market (Holzer, 1996; Lerman, 1996). However, employers often do not consider them to be important hiring criteria for high school graduates (Rosenbaum, 2001).

Farkas et al. (1997) showed that the job performance of workers may be predicted by their level of cognitive ability. However, little research has been conducted on the influence of cognitive ability on education-job mismatch. Robst’s research (2007), which investigated college students’ mismatch between field of study and job attained, showed that low-quality education is related to education-job mismatch. Even though Robst’s study (2007) did not include individual ability manifestly, this study alluded to the belief that the reason for education-job mismatch was in individual differences in cognitive ability.

As for the relationship between cognitive ability and wages, Raudenbush and Kasim (1998) found that literacy scores are a significant predictor of wage differences within an occupation. Murnane, Willet, and Levy (1995) asserted that high school mathematics scores influence wages six years after completing high school and that the wage effect six years after high school is more positively substantial than that two years afterwards. Carbonaro's research (2005) showed that returns to literacy ability vary in demands on skills needed for an occupation. That is, the higher the demands for literacy ability within an occupation, the higher the returns to cognitive skills are.

However, Bowles and Gintis (2001) suggested that cognitive ability only accounts for one quarter of variance in the education-wage relationship. Moreover, when educational level is held constant, cognitive ability has a modest influence on wages. They placed much more emphasis on the relationship between noncognitive ability and wages.

2.9 Non-cognitive Behavior

Little attention has been paid to noncognitive ability and its effect on social economic outcomes, compared to cognitive ability. However, it has been considered as one of the tasks developed in the socialization process. Also, the scope of noncognitive ability in the literature is not exclusive. In the current study, it is defined as a productive behavior (Farkas, 2003) such as a *personality trait* (Bowles & Gintis, 1976), *attendance* (Klein, Spady, & Weiss, 1991), *self-esteem* (Heckman & Yona, 2001), and *interaction* and *motivation* (Moss & Tilly, 2001). In a practical application, the term *soft skill* is frequently used and extensively applied to such indicators as communication skills, teamwork skills, positive work attitudes, responsibilities, etc. (Conrad & Lehigh, 1999).

Noncognitive ability relates to family background and schooling (Farkas, 2003). Many studies on childhood have shown that noncognitive behavior is strongly affected by early childhood parenting and that early differences in socioeconomic status are sustained throughout schooling (National Institute of Child Health & Human Development, 2004) and labor market entry (Jencks et al., 1979). As for the effects of schooling on noncognitive ability, it has been found that noncognitive ability is trainable (Heckman et al., 2006) and that school enhances noncognitive ability by recognizing and reinforcing a productive behavior in the workplace (Bowles & Gintis, 1976).

Earlier, Jencks et al. (1979) suggested that individuals' noncognitive characteristics play a role in acquiring job and socioeconomic status. Bowles et al.'s research (2001) showed that two abilities works differently in the labor market depending on workers' job status—noncognitive ability is more important to lower-level workers than cognitive ability in accounting for the effects of skills on their job status and wages, and vice versa for higher-level workers. Rosenbaum (2001) also asserted that when hiring high school graduates, employers did not refer to applicants' transcripts or math and English skills, which were frequently used in research as a proxy for measuring cognitive traits. Instead, employers preferred to hire candidates equipped with proper noncognitive behaviors such as timeliness and work ethic. As such, a U.S. Army recruiting practice, in which high school graduates with better noncognitive abilities are preferred to GED holders with better cognitive abilities, lends support to differences in required ability by work level (Rothstein, 2004).

The literature has also shown that noncognitive ability affects wages. Klein, Spady, and Weiss (1991) revealed that the wage premium gained by high school graduates compared to high school drop-outs is due to the higher noncognitive ability of high school graduates rather than their productivity. Carneiro and Heckman (2003) showed that two paths account for the effect of noncognitive ability on wages: direct mode and indirect mode through schooling.

2.10 Control Variables

Gender. Female workers are more likely than male workers to be mismatched with regard to education-job mismatch and to receive lower wages (McGoldrick & Robst, 1996).

Race. There is a substantial wage gap between Whites and minorities after controlling for education, work experience, and training. The mismatched workers are more often members of minority groups than Whites (Rumberger, 1981).

***Training*.** Job training outside of schooling is also considered an investment activity that enhances human capital. The literature (Grubb, 1995) has shown that returns on training depend on its relatedness to the job. That is, training related to job performance has a significant influence on wages. According to Groot (1993) and Sicherman (1991), mismatched workers have less on-the-job training than correctly matched workers. Above all, holding a license or certificate can send a positive message to employers about workers' productivity. Kerckhoff and Bell (1998) showed that vocational licenses or certificates gained from post-secondary training—literally, they pay off.

Work Experience. Groot (1996) suggested that work experience has a significant influence on the extent of the job-education mismatch. Also, Sicherman (1991) asserted that the mismatch occurs when younger workers seek to adapt to the world of work.

2.11 Summary

The centrality of the job-education mismatch dispute lies in whether the mismatch is due to individual differences in skill endowments or job competition among individuals in which some seek priority status over others. According to human capital theory, individual ability, including cognitive ability and recently noncognitive behavior, has an influence on job-education mismatch. However, the job competition model suggests that mismatched workers are employed in different jobs in which productivity is different. Incidentally, a network model suggests that the imperfect mechanism linking employees with employers leads to job-education mismatch irrespective of differences in ability among workers or job competition. Job-education mismatch results in underutilizing educationally developed skills in the labor market and produces different returns on the same education. As for the increasing wage differential within groups, diverse sources have been suggested, such as skill-biased technology changes, differentials in minimum wage rates by state, industrial mix, and inflows of females and low-skilled immigrant workers.

The literature for this research was reviewed in terms of developmental tasks that help individuals successfully transition to work, such as family support, career awareness, and work skills. Family background also influences children's job status. Mother's education levels are especially significant in relation to children's occupational exploration and decision making. Also, parental support provides meaningful direction to children as they establish their vocational identity. The influence of career and technical programs in high school on labor market outcomes is inconsistent. Research has been conducted on whether high school students' part-time work distracts them from studying. A few studies have pointed out that high school work enhances employability. As for skills, cognitive ability is a good predictor of job performance, but in the hiring process for high school graduates, cognitive ability is not considered as an important criterion by employers. Instead, the literature shows that noncognitive behavior is more favored by employers, and therefore influences the wages of high school-educated workers.

The literature showed that demographic characteristics such as work experience, gender, race and residential areas may affect job-education mismatch. Constitutional changes in industry and workers' migration to the South and West are exerting an especially significant influence on the employability of high school-educated workers. Last but not least, training is important in enhancing skills and wage rates.

Chapter 3

Methodology

This study's objective was to investigate the school-to-labor market transition of high school-educated workers. In addressing this issue, this study looked at support, awareness, and skills as an important framework for a successful transition. As for outcome variables, this study considered job-education match and wage rate differential within-group. Family background, school experience, and work readiness were incorporated into the potential predictors. This study controlled training credentials and residential region, including demographic characteristics such as work experience, gender, and race.

The data were taken from the National Longitudinal Survey of Youth 1997 (NLSY 97) (U.S. Department of Labor, 2007c). Detailed information about the data, sample selection, measurement of variables, data collection, and data analysis are described in this chapter.

3.1 Data

The data examined in this study were secondary data derived from the NLSY 97 from 1997–2005. The NLSY is designed to aggregate information about the school-to-work transition of youths into adulthood. The NLSY 97 was collected by the National Opinion Research Center (NORC) and the Center of Human Resource Research (CHRR) at Ohio State University and directed by the U.S. Bureau of Labor Statistics. The NLSY 97 is a longitudinal survey of 8,984 residents from 6,819 households ages 12 to 16 as of December 31, 1996 (U.S. Department of Labor, 2007b). The survey drew two kinds of samples: a cross-sectional sample designed to represent the U.S. population born in 1980 through 1984, and a supplemental sample of the Black and Hispanic population born in the same years.

3.2 Population and Sample Construction

3.2.1 Population

The purpose of this study was to investigate the determinants of successful transitions to labor markets by high school-educated workers. To concentrate on the effect of experience in high school on subsequent labor market outcomes, this study restricted the sample to workers who completed only high school. Thus, only workers with high school degrees who had not enrolled in further education from the year of high school graduation to 2006 were targeted. This criterion applied to restrict the population. The target population was set as high school-educated civilian noninstitutionalized workers who had never enrolled in college by 2006, residing in the U.S. and born in 1982 through 1984[1].

3.2.2 Sample Construction

The filtering process used in this study to construct a sample is described in Table 3.1. First, enrollment status items were used to exclude workers who had enrolled in college. The NLSY 97 uses two helpful educational categories to extract only high school degree workers such as *not enrolled: high school degree* and *not enrolled: some college*. This study restricted the sample to the former. Second, based on the listwise deletion criteria for a sample, this study dropped cases that did not have all of the dependent and independent variables for the analysis. Sample size reported in Table 3.1 is for the

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[1] NLSY 97 collected data on cognitive and noncognitive abilities from individuals only born in 1982 through 1984. Therefore, the study population was confined to individuals born in these periods.

longitudinal analyses. Sample sizes for cross-sectional analyses are presented in Tables 4.1–4.14.

Table 3.1 Sample Construction

Sample selection criteria	Valid case (n)
Total sample in 1997	8,984
Not enrolled after high school graduation in 2006	1,588
Completed high school by 2003	1,137
Complete data set on independent variables	583
Complete data set on control variables	570
Final sample	570

3.3 Dependent Variables

Outcome variables were measured as of the eighth and ninth rounds when most respondents' ages were 20–24. In the NLSY 97, information on respondents' occupation and wages was requested for "employee jobs lasting more than 13 weeks as of the job's end date" (U.S. Department of Labor, 2007b, ¶ 4.3.7). When respondents changed occupations within the round concerned, this study utilized the final occupations and their corresponding wages. This study used the created variable for occupational code and wage rates found in the NLSY 97.

3.3.1 Education-Job Match

Two types of education-job match variables were used as a dependent variable. The difference lies in the treatment of how the respondent's jobs, ranging from Job Zones 2–5 as shown in Table 3.2, matched between required and attained education. First, those jobs were pooled together and treated as the same matched nominal data. Second, this study utilized the characteristics of a hierarchically classified category in the Job Zone—i.e., the higher the respondent's category in the Job Zone, the better the extent of the job-education match.

First, this study compared required education for jobs with attained education of workers (Rumberger, 1981). A Job Zone hierarchy in O'NET was used to ascertain the required education for jobs. A Job Zone provides educational level, allowing us to judge whether workers were matched to jobs according to educational credentials. As shown in Table 3.2, the Job Zone in O'NET categorizes jobs into five sections based on the following criteria: work-related skill and knowledge, amount of training required, and educational level. Meanwhile, in order to measure the educational attainment of workers, jobs need to be coded in the same way as O'NET. The NLSY 97 collected information for all employee jobs lasting more than thirteen weeks, and coded jobs with 2002 Census four-digit occupation classifications (U.S. Department of Labor, 2007b). The four-digit codes are provided along with equivalents of six-digit Standard Occupational Classification (SOC) codes used by O'NET. Thus, this study was able to compare job information in O'NET with workers' information in the NLSY 97. In the case of jobs having multiple Job Zones above Job Zone Two, the lower level was used for the required educational level. See Appendix A for more specific information on the job codes of individual workers. To judge between match and mismatch, this study assumed that jobs in Job Zone Two and over were the matched for high school graduates. This is because jobs in Zone Two usually require a high school diploma and jobs requiring more than high school could also be considered part of a successful transition. The mismatched workers were coded 0 and the matched workers were coded 1.

Table 3.2 Description of Job Zone in O'NET

Job zone	Extent of preparation needed	Specific Vocational Preparation (SVP)	Education
1	Little or No Preparation	Less than six months	These occupations may require a high school diploma or GED certificate.
2	Some Preparation	Over six months to two years	These occupations usually require a high school diploma and may require some vocational training or job-related course work.
3	Medium Preparation	Over two years to four years	Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree
4	Considerable Preparation	Over four years to ten years	Most of these occupations require a four - year bachelor's degree
5	Extensive Preparation	Over ten years	A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school.

Note. Table content is obtained and revised from http://online.onetcenter.org/help/online/zones.

Second, to utilize the ordered category of surplus schooling applied to workers who held jobs requiring more than high school, the ordered category of the Job Zone was used such as 1, 2, 3, 4, and 5, where 1 stands for workers who were employed in the job requiring less than high school, i.e., Job Zone One, and 2, 3, 4, 5 represent workers who held jobs in Job Zone Two to Five requiring greater than high school.

3.3.2 Log Hourly Compensation Wage Rates

Rather than the typical measure of wage rates, the hourly compensation wage rates created by NLSY 97 were used to maximize variance in individual wage rates and reflect on the growing share of extra compensation in wages (Lazear & Shaw, 2007). According to the NLSY 97 User Guide (U.S. Department of Labor, 2007b, ¶ 4.3.11),

Figure 3.1 Frequency distribution of hourly compensation wage rates, 2005.

Note. The measurement unit for the hourly wage rates is cents.

Figure 3.2 Frequency distribution of the log hourly compensation wage rates, 2005.

these wage rates included all types of compensation, such as overtime and performance pay as well as basic salary. The overtime and performance pay incorporated all types of extra compensation such as overtime, tips, bonuses, etc. For the longitudinal analysis, wage rates for 2003 and 2006 were adjusted for inflation and reflected the dollar value for 2006. As shown in Figure 3.1, the distribution of wage rates was positively skewed with median wage rates smaller than the mean. Therefore, to correct the skewed data, the wage rates were converted into the natural log wage rates, and the log values were used as the dependent variable.

As this study sampled only high school-educated workers, wage rate differentials explained by each predictor could be determinants for within-group wage rate inequality. Our focus for within-group wage rate inequality was placed on the source of wage inequality rather than the extent or change in wage inequality.

3.4 Independent Variables

3.4.1 Socioeconomic Status (SES)

Socioeconomic status was measured by parents' education. Mother's highest education level was considered, reflecting current research which showed that youths turn to mothers for advice on their career (Otto, 2000). According to Erikson and Jonsson's suggestion (1996) that parents who experienced their children's educational attainment were more likely to have children who were prepared for their career than those who did not, mothers' education level was regrouped into two categories and dummy-coded for analysis: less than high school and equal to or greater than high school. In those cases in which the mother's education level was missing, it was replaced with the father's education level. Parents' education level was collected from round one. The reference group for dummy coding was less than high school.

3.4.2 Parental Supportiveness

Due to significant amounts of missing data on fathers' responses, only mothers' responses were used. This study used parental supportiveness items measured in two ways: the first one manifestly asked respondents whether they felt that their parents were supportive of them. The responses were rated on three levels of supportiveness, i.e., *very supportive*, *somewhat supportive*, and *not very supportive*, and coded as 1, 2, and 3, respectively. These were reverse-coded to indicate that a higher score meant greater parental supportiveness. This measurement was acquired in the senior year of high school.

3.4.3 High School Curriculum

The course of study respondents took in high school was measured with five different responses: general program, college preparatory, vocational and technical, comprehensive course of academic and vocational program, and others. The course of study was dummy-coded and the reference category was general program. This measurement was obtained from the rounds 1–7. For those who changed their course of study, it was measured at the year of or prior to the year of high school graduation.

Also, the school-based work programs the workers attended in high school were considered. The NLSY 97 surveyed respondents about their participation in seven different types of programs: career major, cooperative education, internship/apprenticeship, job shadowing, mentoring, school-based enterprise, and Tech-Prep. Definitions for those programs are provided in Table 3.3. Measurement was related to whether respondents participated in these programs in high school or not. These measurements were acquired from rounds 1–7.

School-Based Learning Programs

Table 3.3 Definition of School-based Learning Programs

Program	Definition
Career major	A coherent sequence of courses based upon an occupational goal.
Cooperative education	Students alternate or parallel their academic and vocational studies with a job in a related field.
Internship/ apprenticeship	Students work for an employer for a short time to learn about a particular industry or occupation.
Job shadowing	A student follows an employee for one or more days to learn about an occupation or industry.
Mentoring	A student is paired with an employee who assesses his or her performance over a period of time, during which the employee helps the student master certain skills and knowledge.
School-sponsored enterprise	The production of goods or services by students for sale or use by others. Enterprises typically involve students in the management of a project.
Tech-prep	A planned program of study with a defined career focus that links secondary and post-secondary education.

Source. U.S. Department of Labor (2007b).

3.4.4 Work Experience during High School

The NLSY 97 classified jobs into three categories: employee jobs, freelance jobs, and self-employment. Of special interest to us were employee jobs in which respondents were involved in an ongoing relationship with an employer. If they were employed, the amount of time spent at work was considered. As for hours worked, cumulative hours worked from ages 14–19, which was created by the NLSY 97, were used for each respondent. The NLSY 97 asked respondents for their number of work hours per week and duration of employment during the time span between surveys. The cumulative work hours were calculated from both weekly work hours and number of weeks worked inferred from the starting and ending dates of jobs. Work hours divided by 1,000 hours were used.

3.4.5 Cognitive Abilities

The NLSY 97 includes the most frequently used measurement for cognitive abilities in the literature—the Armed Forces Qualification Test (AFQT). The AFQT has been designed to measure the trainability of newly enlisted soldiers. The AFQT in the NLSY 97 is the transformed unofficial test, which is called the Armed-Services Vocational Aptitude Battery (ASVAB). This study used arithmetic reasoning from four tests measuring verbal and mathematical ability: (a) arithmetic reasoning, (b) mathematical knowledge, (c) word knowledge, and (d) paragraph comprehension. The scores on arithmetic reasoning were standardized. This measurement was acquired from round one of the NLSY 97.

3.4.6 Noncognitive Behavior

This study used a self-esteem subscale from two types of questionnaires administered by the NLSY 97 to assess noncognitive behavior: a self-esteem subscale and a short form of Achenbach's Youth Self Report (YSR). The self-esteem scale is composed of four items, as shown in Table 3.4. The items were scaled at four levels: *strongly disagree*, *disagree*, *agree*, and *strongly agree*. The first two negative items were reverse-coded in order for higher scores to reflect more self-esteem. However, factor analysis showed that items loaded on two different factors between the first two items and the second two items. The mean index, which was based on the first two items, was used in this study. (Cronbach's α = .58). This measurement was acquired from round one of the NLSY 97.

Table 3.4 Items for Measuring Noncognitive Behavior

Type	Item
Self-esteem scale	
	I hardly ever expect things to go my way
	I rarely count on good things happening to me
	I'm always optimistic about my figure
	In uncertain times, I usually expect the best
Achenbach's Youth Self Report	
Male	You lie or cheat
	You don't get along with other kids
	You have trouble concentrating or paying attention
	You are unhappy, sad, or depressed
Female	You lie or cheat
	Your school work is poor
	You have trouble sleeping
	You are unhappy, sad, or depressed

Source. U.S. Department of Labor (2007b).

3.5 Control Variables

Gender. Males were coded 0 and females were coded 1.

Race. Four racial categories were included in the analysis: Whites, Blacks, Hispanics, and others. Categories were dummy-coded with Whites as the reference group.

Training Certificate. Whether respondents received training credentials by the time of year concerned was controlled. Those who received the training certificate were coded 1 and those who did not were coded 0.

Work Experience. Work experience was measured by subtracting the year of high school graduation for each individual worker from the year when job and wage rates were measured.

3.6 Sample Weights

Sampling weights are adjustment for differences in the probability of selection between cases in a sample due to over-sampling or non-response (Lee, 2006). In the NLSY 97 surveys, the sample was selected either with equal probability of a cross-sectional sample or with unequal probability of an oversample to expand the statistical availability for Blacks and Hispanics (U.S. Department of Labor, 2007b). Thus, weights were applied to secure the proper representation of tabulations based on statistics (Lee, 2006). Initial longitudinal sample weights for multiple survey years were produced by the NLSY 97 Custom Weighing Program. Use of this initial weight tends to decrease the standard error by making the sample size larger (Thomas, Heck, & Bauer, 2005). Above all, using the initial weight makes every coefficient significant as a result of treating the population size as the sample size (Thomas et al., 2005). To correct the initial weight, the initial weights were divided by the average of the initial weights. That is, the initial weights were standardized. This standardization was applied to each case in the research. The new weight was calculated as follows:

$$\text{New Weight} = \frac{\text{Initial Weight}}{\text{Average of Initial Weights}}$$

where:

> the New Weight is the new calculated weight for each case; Initial Weight is provided by the NLSY 97 Custom Weighing Program; and Average of Initial Weight is the average of initial weight in cases included in our analysis.

The New Weight rescales the weighted data to reflect the effects of the actual sample size on the variable (Lee, 2006).

3.7 Data Analysis

Initially, descriptive statistics were used to describe characteristics of variables and the relationship between variables. Then, different analysis methods were applied to research designs used in this study: cross sectional study or longitudinal study. For the cross-sectional design, bivariate regression between dependent and independent variables was employed to identify potential candidates for independent variables. Then, to assess the degree to which each independent variable was related to dependent variables, this study examined each association at a time in inferential statistics by adding the independent variables to the model one by one in order to assess how the previous relationship changed by adding variables. Lastly, this study assessed them together to determine relative contributions. For the longitudinal design, the growth model was applied using the same method of entering predictors to a model. Overall, this study set all significance levels at .05.

Also, this study applied the Best Subsets Method using Minitab statistical software to select the best or good subsets of independent variables among transition-related variables under study to be employed in the multiple regression models. The Best Subset Model is an algorithm identifying a small number of good predictors by applying such criteria as R^2 criterion, Mallow's C_p criterion, Akaike's information criterion (AIC_p), and Schwarz' Bayesian criterion (SBC_p) (Kutner, Nachtsheim, & Neter, 2004). The latter three criteria tend to decrease when adding predictors to a model, whereas the value of R^2 favors more predictors. Therefore, the Best Subset algorithm is a procedure seeking predictors that maximize the R^2 value and simultaneously minimize the latter three criteria (Kutner et al., 2004).

3.7.1 Research Question One

The first research question sought a description of the extent of job-education mismatch. First, descriptive statistics were used to describe the transition-related and control variables. To tackle these tasks, this study calculated mean, standard deviation, frequency, and relative frequency for the transition-related and control variables. Then, to describe the relationship between transition-related variables and job-education match, this study considered the frequency and relative frequency of the job-education match. The job-education mismatch was judged by contrasting the educational requirements for jobs and educational attainment of workers. The educational requirements for each job were obtained from O'NET (see Appendix A). The frequency pattern for each individual worker in the occurrence of job-education mismatch over rounds 8–10 was analyzed.

Also, the first research question sought to estimate the extent to which transition-related variables were associated with job-education match in each year. Multiple logistic regression was used for a statistical inference to identify the independent variables that increase or decrease the probability of job-education match (Pampel, 2000). After fitting separate logistic models to each round, this study compared coefficients among rounds to find their change. To use this analysis method, the dependent variable, i.e., the event of a job-education match, was categorized into two groups: the job-education mismatched group was coded 0, whereas the matched group was coded 1. As shown in Equation 1, in the probability of an event in which the job-education match has a nonlinear relationship with independent variables, the natural logarithm of the odds, i.e., a logit or a log portion of occurrence to nonoccurrence, transformed nonlinearity into linearity, as shown in Equation 3 (Grimm & Yarnold, 1997). The coefficients β_1 and β_2 in Equation 3 are interpreted as the change in log odds by a unit change of X_1 *and* X_2, but not intuitive (Pampel, 2000). Thus, an odds ratio, i.e., an exponential of coefficients ($=e^{\beta 1}$ *and* $e^{\beta 2}$), is used to define the multiplicative effects on odds when the dependent variable is increased by one unit (Pampel, 2000).

$$P\,(\textit{Job-Education Match}) = \frac{e^{\beta 0 + \beta 1X1 + \beta 2X2\ldots}}{1 + e^{\beta 0 + \beta 1X1 + \beta 2X2\ldots}} \tag{1}$$

$$\frac{p}{1 - p} = e^{\beta 0 + \beta 1X1 + \beta 2X2\ldots} \tag{2}$$

$$Log\,\frac{p}{1 - p} = \beta 0 + \beta 1X1 + \beta 2X2\text{----} \tag{3}$$

where

P means probability of the job-education match occurrence; $\beta 0$ is an intercept; $X1$, $X2$ ...stand for dependent variables; $\frac{P}{1-P}$ describes the odds of being in the category of the job-education match; $\beta 1$ *and* $\beta 2$ signify the log odds ratio.

Third, this study used ordinal regression to utilize the ordered category of the job-education matched workers who held jobs requiring more than a high school education. The ordered category for this analysis was coded as 1, 2, 3, 4, and 5, with 1 standing for workers employed in the job requiring less than high school, i.e., Job Zone 1; 2 means an exact match for workers in Job Zone 2; and 3–5 represent workers who held jobs in Job Zones 3–5, respectively. Ordinal regression has an advantage over multinomial regression in that ordinal regression utilizes the ordering of the categories and estimates the single slope coefficient (Kutner et al., 2004). Unlike logistic regression, in ordinal regression the cumulative probability, i.e., "the probability of that event and all events that are ordered before it" (SPSS, 2006, p. 70), is considered rather than an individual category. The cumulative logit $Ln\ \Theta_j$ in the Equation 5 produced the identical slope β but different intercepts α_j. The cumulative odds ratio, i.e., an exponential of coefficients (e^{β}), was used to define the multiplicative effects on cumulative odds of a unit change in the dependent variable.

$$\Theta_j = \frac{Prob\ (score \leq j)}{Prob\ (score > j)} = \frac{Prob\ (score \leq j)}{1\text{-}Prob\ (score \leq j)} \qquad (4)$$

$$Ln\ (\Theta_j) = \alpha_j + \beta X_i \qquad \text{for } j = 1,\ \ldots,\ J\text{-}1 \qquad (5)$$

where

Θ_j = the cumulative odds for j; α is a threshold value; β is a coefficient.

3.7.2 Research Question Two

The second question dealt with the extent to which the transition-related variables were associated with the within-group wage rate differentials. To analyze the influence of the transition-related variables on hourly wage rates, the multiple regression method was used. The dependent variable was log hourly wage rates.

3.7.3 Research Question Three

The third question investigated the relationship between job-education match and wage rates and explored how the job-education match influenced transition-related variables and wage rates. First, the multiple regression model was used, including transition-related variables, wage rates, and four control variables. Second, the job-education match variable as one of the independent variables was added to the above regression model. To determine the relative importance of variables in the model, the Best Subset Method was applied.

3.7.4 Research Question Four

Research question four examined how relationships observed in research Questions One–Three changed over time. This study used a *two-level nested growth model*, which involves repeated measurements (level-one) nested within individuals (level-two) (Hox, 2002). Time or an alternative to time is essential at level-one in the growth model and predictors are required at level-two to specify the time effect (Willett, Singer, & Martin, 1998). Formulating a level-two model for a slope of the time variable in a level-one model allows specification of the interaction of the time variable with time-invariant variables in level-two and thereby estimation of the growth rate for individuals over occasions (Raudenbush & Bryk, 2002; Schuster & von Eye, 1998). Other strengths of the growth model stem from the usefulness of missing measurements on the dependent variable as well as a short time period (Hox, 2002; Raudenbush & Bryk, 2002).

This study utilized the strengths of the growth model for missing values on the dependent variable. According to Willett et al. (1998), at least three rounds of longitudinal data are needed to employ a linear growth model. To lessen the weakness of the data over a short period of time, this study employed “an accelerated longitudinal design” (Willett, et al., 1998, p. 409) in which data were composed of multiple age cohorts for a shorter length of time.

The time variable in level-one was *Work Experience* and *a Training Certificate.* The matrix of time variables was identified through an examination of the relationship with *Job-Education Match* and *Log Hourly Wage Rates*. Meanwhile, in order for the intercepts to be interpretable, all continuous predictor variables at level-2 were grand mean centered by subtracting the mean value from the value of the variables. Also, centering was helpful for interpreting interactions among variables and reducing mulicollinearity (Hox, 2002; Schuster & von Eye, 1998).

First, this study examined how the relationship observed in Research Question One changed over time. A *binary growth model* was employed, i.e., the extent of the job-education match depended on the repeated measurement nested within individual characteristics such as the transition-related variable and control variables. At the repeated measures levels (level-one), time-variant variables were included in a model. Initially, it was assumed in the level-one model that the log odds for the job-education match at time points *t* for individual *i* depended on *work experience* (T_{ti}) and *a training certificate* (X_{ti}). Then, this study proceeded to build a model by considering the inclusion of variables and specifying their coefficients (Raudenbush & Bryk, 2002). The tentative equation was depicted as follows:

$$\eta_{ti} = \log [\pi_{ti}/(1- \pi_{ti})]$$

$$\eta_{ti} = \beta_{0i} + \beta_{1i}T_{ti}(Work\ Experience) + \beta_{2i}X_{ti}(Training\ Certificate)$$

where:

η_{ti} is the log-odds that job-education has matched; π_{ti}= *(Job-Education Match)* $_{ti}$ = the probability of being matched (π_{ti}= 1) or not (π_{ti}= 0) when individual *i* measured at time point *t*; β_{0i}= the intercept; β_{1i} and β_{2i}= slope coefficients that indicate log odds ratio of individual *i*; T_{ti} = *Work Experience*; X_{ti}= *Training Certificate.*

At the individual level (level-two), the intercept β_{0i} and slopes β_{1i} and β_{2i} were modeled by time-invariant variables (Z_{ji}), i.e., selected variables among *SES, Parental Supportiveness, High School Curriculum, Work Experience during High School, Cognitive Ability, Noncognitive Behavior, Gender, and Race.* Because our objective was to examine change over time in job-education match and the impact of transition-related variables on job-education match, this study needed to "incorporate information about the timing of an observation relative to the event of interest" (Osgood, 2005, p 18). Therefore intercepts (β_{0i}) and coefficients for *Work Experience* (T_{ti}) *and Training Certificate* (X_{ti}) were specified with time-invariant variables (Z_{ji}).

$$\beta_{0i} = \gamma_{00} + \sum_{j=1}^{j} \gamma_{0j} Z_{ji} + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + \sum_{j=1}^{j} \gamma_{1j} Z_{ji} + u_{1i}$$

$$\beta_{2i} = \gamma_{20} + \sum_{j=1}^{j} \gamma_{2j} Z_{ji} + u_{1i}$$

where:

β_{0i}, β_{1i}, *and* β_{2i}, = regression coefficients of the repeated measure-level equation; γ_{00}, γ_{10} , *and* γ_{20} = the intercepts; γ_{0j}, γ_{1j}, *and* γ_{2j} = slopes that indicate the association between the repeated measures-level predictors and the individual-level regression coefficients; Z_{ji}= the *j* th time-invariant variables in the individual *i*; u_{ji}, = the residual error terms that indicate a unique effect associated with individual *i*. Variations among repeated measurements that are not accounted for by the predictors are captured by these residual terms. These residuals are assumed to have a mean of zero, and the variances are specified as τ_{00} and τ_{11}, respectively.

Second, this study examined how the relationship observed in Research Question Two and Three changed over time. This study utilized *a general growth curve analysis* for longitudinal data. The equations below show that wage rates depend on the repeated measurement nested within individual characteristics such as the transition-related variable and control variables. At the repeated measures levels (level-1), time-variant variables were included in a model and the tentative model was depicted as:

$$Y_{ti} = \beta_{0i} + \beta_{1i} T_{ti}(\textit{Work Experience}) + \sum_{n=2}^{n} \beta_{ni} X_{ti} + e_{ti}$$

where:

Y_{ti}= wage rates of individual *i* measured at time point *t*; β_{0i}= the intercept; β_{1i}, $\beta_{2i}, \ldots,$ and β_{ni} = slopes that indicate the association between predictors and log hourly wage rates of individual *i;* X_{ti}= time variant variables, i.e., the selected variables among potential candidates such as *Job-Education Match* and *Training Certificate*; e_{ti}= the residual term that indicates a unique effect associated with wage rates Y_{ti}. These residual wage rate effects are assumed to be normally distributed with a mean of 0 and a variance σ_e^2. Time points (*t*) were coded as *t* = 0, 1, 2, and 3 for rounds 7–10, respectively.

At the individual level (level-2), the intercept, i.e., β_{0i}, and the slopes, β_{ni}, were modeled by time-invariant variables (Z_{ii}), i.e., the selected variables among *SES, Parental Supportiveness, High School Curriculum, Work Experience during High School, Cognitive Ability, Noncognitive Behavior, Gender, and Race.* Initially, slopes, i.e., β_{0i}, …, β_{ni} were allowed to vary randomly.

$$\beta_{0i} = \gamma_{00} + \sum_{j=1}^{j} \gamma_{0j} Z_{ji} + u_{0i}$$

$$\beta_{1i} = \gamma_{10} + \sum_{j=1}^{j} \gamma_{1j} Z_{ji} + u_{1i}$$

. . .

. . .

$$\beta_{ni} = \gamma_{n0} + \sum_{j=1}^{j} \gamma_{nj} Z_{ji} + u_{ni}$$

where

β_{0i}, β_{1i}, …., *and* β_{ni}= regression coefficients of the repeated measure-level equation; γ_{00}, γ_{10},…. and γ_{n0} = the intercepts; γ_{0j}, γ_{1j} …, and γ_{nj} = slope coefficients that indicate the association between the repeated measures-level predictors and the individual-level regression coefficients; Z_{ji} = the j th time-invariant variables in the individual i; u_{0i}, u_{1i}, …., and u_{ni}= the residual terms that indicate a unique effect associated with individual i. Variations among repeated measures not explained by the predictors are captured by these residual terms. These residual terms are assumed to have a mean of zero, and the variances are specified as τ_{00}, …, and τ_{nn}, respectively.

Table 3.5 provides a summary of research questions, variables and analysis techniques.

Table 3.5 Variables and Data Analysis Methods by Research Question

Research question	Key variable	Scale	Data analysis
1. To what extent are transition-related variables associated with the successful school-to-work transition of high school graduated workers in respect to educational match?	Social Economic Status	Nominal	Descriptive statistics Logistic regression Ordinal regression
	Parental supportiveness	Interval/ratio	
	High school curriculum	Nominal	
	School to work programs	Nominal	
	Work experience in high school	Interval/ratio	
	Cognitive ability	Interval/ratio	
	Noncognitive behavior	Interval/ratio	
	Job-education match	Nominal/Ordinal	
2. To what extent are transition-related variables associated with the within-group wage rate differential?	Social Economic Status	Nominal	Multiple regression
	Parental supportiveness	Interval/ratio	
	High school curriculum	Nominal	
	School to work programs	Nominal	
	Work experience in high school	Interval/ratio	
	Cognitive ability	Interval/ratio	
	Noncognitive behavior	Interval/ratio	
	Wage rates	Interval/ratio	
3. What is the relationship between educational mismatch and wage rates for high school educated workers?	Social Economic Status	Nominal	Multiple regression
	Parental supportiveness	Interval/ratio	
	High school curriculum	Nominal	
	School to work programs	Nominal	
	Work experience in high school	Interval/ratio	
	Cognitive ability	Interval/ratio	
	Noncognitive behavior	Interval/ratio	
	Job-education match	Nominal	
	Wage rates	Interval/ratio	
4. How does the relationship observed in Question One to Three change over time?	Social Economic Status	Nominal	Hierarchical linear model (Growth model)
	Parental supportiveness	Interval/ratio	
	High school curriculum	Nominal	
	School to work programs	Nominal	
	Work experience in high school	Interval/ratio	
	Cognitive ability	Interval/ratio	
	Noncognitive behavior	Interval/ratio	
	Job-education match	Nominal	
	Wage rates	Interval/ratio	

Note. Control variables: gender, race, training certificate, and work experience

Chapter 4

Findings

The objective of this study was to investigate the relationship between transition-related variables, which were related to experience during high school, and two dependent variables: job-education match and log hourly wage rates. To control for the events of human capital accumulation after high school graduation, work experience and training were considered. Since dependent variables were collected from respondents with different numbers of years of work experience at multiple time points (2003–2006), two different research designs were applied in this study: cross-sectional and longitudinal. The results for the cross-sectional analysis are presented in sections 4.2–4.4 and those for the longitudinal analysis are presented in section 4.5.

4.1 Descriptive Statistics[2]

Table 4.1 shows the frequency, means, and standard deviations for variables considered in this study; the presented frequency is unweighted, but the means and standard deviations are weighted. A total of 570 workers (326 males, 244 females) were considered in this study[3]. Sixty-seven percent of the respondents were White, while Black, Hispanic, and other minorities represented17%, 6% and 10% of the sample, respectively. In 2003, 20% of the respondents possessed a training certificate, and 34%

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[2] Statistics presented in Table 4.1 are from workers who never enrolled beyond high school for further education 3 to 6 years after high school graduation. The proportions for gender, race, parental education, high school course of study, participation in school-to-work programs, and hours worked in high school differ from those for all high school graduates.

[3] Means of job-education match rates and wage rates for 567 deleted cases were compared to the means of the 570 cases incorporated cases in this study. There were no differences between the means in the two groups

had a training certificate in 2006. Respondents' average number of years of work experience after high school graduation in 2006 was 4.43: the minimum was 3 and the maximum was 6. In 2003, 62% of workers held jobs requiring at least a high school education; the same was true for 73% in 2006. The Job Zone hierarchy shows that most of the high school workers were employed in job categories of less than 4. Compared to the 2003 wave distribution for Job Zone hierarchy, the 2006 wave shows that respondents in 2006 tended to hold higher-status jobs but there was no difference in job categories 4 and 5; this is indicative of the glass ceiling that high school diploma holders could reach. The average log (real) hourly wage rates increased linearly from 2003–2006; the paired sample *t*-test showed significant differences in mean log real hourly wage rates between waves. Forty-seven percent of the respondents' parents had a high school diploma; 22% had less than a high school degree; and about 21% had a college degree. Around 70% had pursued a general course of study in high school, while the other 30% had taken courses related to specific purposes: 11% took college preparatory courses; 11% took vocational courses; and 8% took comprehensive courses. Almost half of the workers (45%) took career major programs in high school and around 20% participated in cooperative or tech-prep programs. On average, respondents worked 3,620 hours during high school, which corresponds to 2.5 hours every day for four years.

Table 4.1 Descriptive Statistics

Variable	*n*	*M(SD)*
Control variable*(n=570)*		
Gender		
Male	326	.58
Female	244	.42
Race		
White	289	.67
Black	163	.17
Hispanic	50	.06
Other	68	.10
Training certificate		
2003	109	.20
2004	141	.26
2005	167	.31
2006	185	.34
Work experience		
2003	570	1.43 (.89)
2004	570	2.43 (.89)
2005	570	3.43 (.89)
2006	570	4.43 (.89)
Dependent variable		
Job-education match		
2003	255/412	.62 (.48)
2004	273/415	.67 (.47)
2005	303/408	.75 (.43)
2006	317/441	.73 (.44)
Job Zone hierarchy (Ordered job category)		
2003		
1	157/412	.38
2	180/412	.44
3	62/412	.16
4	12/412	.03
5	1/412	.00
2006		
1	124/412	.27
2	214/415	.48

Table 4.1 (continued).

	n	*M(SD)*
3	86/408	.21
4	15/441	.03
5	2/412	.01
Log (real) hourly wage rates		
2003	407	6.65 (.66)
2004	410	6.79 (.52)
2005	410	6.95 (.68)
2006	475	7.03 (.69)
Parental background *(n=570)*		
Parental supportiveness [a]	570	2.65 (.53)
Parental education		
Less than high school	145	.25
High school diploma	313	.55
Associate's degree	73	.13
Bachelor's degree or above	39	.07
High school experience (*n=570*)		
Course of study		
General	386	.69
College-prep	70	.11
Vocational	65	.11
Comprehensive	42	.08
Other	7	.01
School-to-work program		
Career major	268	.45
Job shadow	145	.26
Cooperative	113	.21
Tech-prep	114	.20
Enterprise	72	.12
Internship	69	.12
Mentor	53	.07
Employment in high school (in 1000hrs) [b]	570	3.62 (2.61)
Ability (*n=570*)		
Self-esteem [c]	570	2.64 (.71)
Cognitive ability [d]	570	0 (1.00)

Note. Skewness values are [a]-1.17, [b]1.11, [c].72, [d].09. Weighted mean (*M*) and standard deviation (*SD*) are presented but unweighted frequency (*n*) is presented.

4.2 Cross-sectional Study on Factors in Job-Education Match

This section includes the results from the cross-sectional analysis which involved workers from the four different cohorts, as determined by high school graduating class, at the same wave of NLSY 97. First, patterns of job-education match by cross-sectional waves are presented. Then, the results of binary logistic regression and ordinal logistic regression, which are differentiated by the categorical nature of dependent variables, i.e., binary or ordered category of job-education match, are presented.

4.2.1 Trajectory of Job-Education Match Rate and Identification of Cohort Difference

Table 4.2 and Figure 4.1 illustrate that the mean percentage of job-education match rates is closely related to number of years of work experience after high school graduation within the same wave. However, there are some exceptions between cohorts for 2002 and 2001. Each wave's trajectory for mean percentage of job-education match rates takes on a stair-step shape with a backdrop of work experience. This suggests that one of two cohorts, 2002 and 2003, is detached from the linear relationship between mean job-education match rates and work experience. These are indicative of cohort effects for the waves for 2004 through 2006. The cohorts, determined by high school graduating class, were defined as follows: Cohort 4, high school graduation year of 2000; Cohort 3, high school graduation year of 2001; Cohort 2, high school graduation year of 2002; and Cohort 1, high school graduation year of 2003. To identify cohort differences, job-education match was regressed on work experience and cohort dummies. As shown in the first row of Table 4.1, for the 2003 wave there was no cohort difference; cohort dummies exhibited mulicollinearity with work experience.

Table 4.2 Mean Job-Education Match Percentage (Weighted), by Cross-Sectional Waves and Years after High School Graduation

		Years after high school graduation						
	n [a]	0	1	2	3	4	5	6
Mean matching rate		48%	59%	66%	68%	77%	77%	85%
Cross-sectional wave								
2003	412	46%	60%	70%	77%			
2004	415		60%	67%	66%	80%		
2005	408			65%	78%	75%	83%	
2006	441				58%	76%	72%	85%
Cohort (Class)					Class 2003	Class 2002	Class 2001	Class 2000

Note. [a]Average unweighted observations across years after high school graduation. Cohort memberships are indicated by the cell shading.

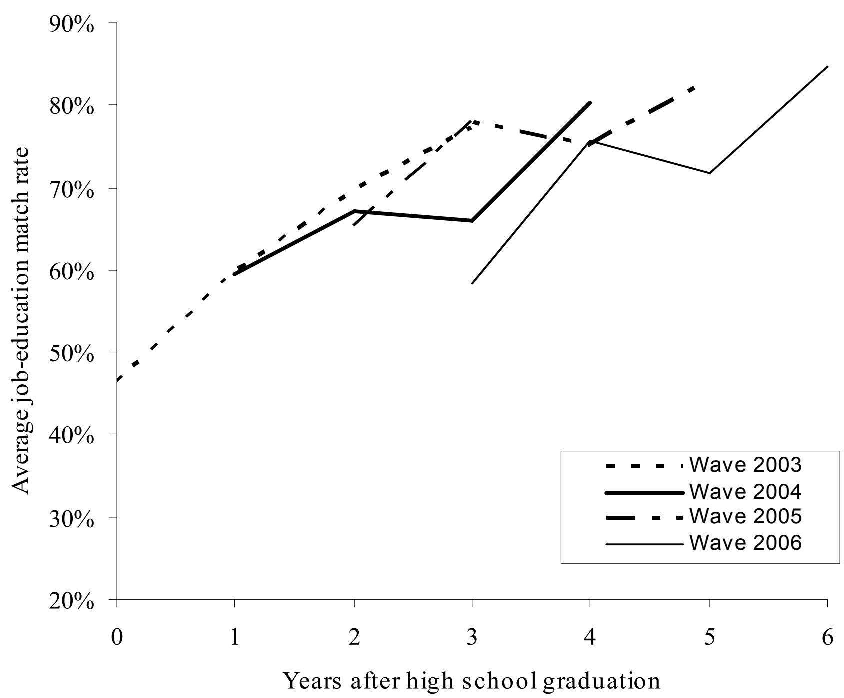

Figure 4.1 Average job-education match rates by cross-sectional waves

Additional bivariate analysis showed that for the 2004 wave, the class of 2003 departed from a linear line linking each cohort, whereas for the waves for 2005 and 2006, the class of 2002 departed from a linear line linking cohorts. To fit the relationship between job-education match and work experience into the data, these cohort differences within the same wave were reflected by including dummy variables for cohort membership in a model with work experience. Meanwhile, the figure for the 2006 wave shifted downward compared to the waves for 2004 and 2005. This is indicative of a period effect[4]. The relationship between job-education match and transition-related variables may be compounded by this source.

4.2.2 Results of the Bivariate Logistic Regression for Factors Related to Job-Education Match

Table 4.3 shows the bivariate logistic regression analyses of data from each wave, which was not adjusted for other variables. The number of years of work experience after high school graduation was positively associated with job-education match. The cohort dummy was close to significant only in the 2006 wave (p =.06), but modeling cohort difference helped the coefficient of work experience to stay significant. Being Black was negatively associated with job-education match in the 2003 wave, but as the wave increased, the size and statistical significance of coefficients for Black decreased considerably. Gender differences in job-education match were shown only in the 2006 wave and male workers showed a higher job-education match rate than female workers ($\beta = .48$, $p = .04$). Analysis of the 2006 wave data indicated that parental education less than high school was negatively associated with job-education match. Parental support in

[4] The source of the period effect cannot be identified by the analysis of the targeted data set.

Table 4.3 Results of the Bivariate Logistic Regression between Job-Education Match and Potential Predictors, by Cross-Sectional Years

	2003		2004		2005		2006	
Independent variable	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Work experience	.47 (.13)	.00	.34 (.15)	.03	.28 (.14)	.04	.38 (.14)	.01
Class 2002					.38 (.27)	.15	.48 (.26)	.06
Class 2001			-.39 (.28)	.17				
Black [a]	-.51 (.26)	.04	-.45 (.27)	.09	-.42 (.28)	.13	-.25 (.27)	.35
Hispanic [a]	-.15 (.38)	.69	-.08 (.40)	.83	-.35 (.43)	.41	-.13 (.43)	.76
Other-race [a]	.42 (.38)	.27	.52 (.35)	.14	-.52 (.40)	.18	-.89 (.36)	.01
Gender	.06 (.22)	.79	.31 (.23)	.17	.18 (.25)	.48	.48 (.23)	.04
Less than HS [b]	-.42 (.26)	.11	-.31 (.26)	.24	-.35 (.29)	.23	-.51 (.28)	.07
2Yr college [b]	-.17 (.34)	.62	-.35 (.34)	.29	-.36 (.38)	.34	-.87 (.33)	.01
4Yr college [b]	.03 (.48)	.96	.43 (.53)	.41	.17 (.55)	.75	-.34 (.09)	.47
Parental support	-.05 (.22)	.81	.06 (.21)	.77	-.14 (.09)	.11	-.05 (.05)	.37
College_prep [c]	-.10 (.32)	.76	.27 (.35)	.44	.38 (.39)	.33	.22 (.36)	.55
Vocational [c]	.44 (.36)	.22	.28 (.36)	.44	.21 (.39)	.60	.25 (.37)	.49
Comprehensive [c]	.98 (.51)	.05	.66 (.45)	.14	1.20 (.60)	.04	.61 (.49)	.22
Other_course [c]	-1.28 (.96)	.18	-1.24 (1.23)	.32	-.54 (1.28)	.67	.09 (1.18)	.94
Cooperative program [d]	.89 (.31)	.00	.94 (.33)	.00	1.10 (.39)	.01	1.26 (.41)	.00
HS employment	.05 (.04)	.22	.07 (.05)	.12	.14 (.05)	.01	.13 (.05)	.01
Self-esteem	.49 (.17)	.00	.62 (.18)	.00	.57 (.20)	.00	.33 (.17)	.05
Cognitive	-.40 (.12)	.00	-.19 (.12)	.11	-.06 (.13)	.61	-.15 (.11)	.19
Training certificate [e]	.62 (.32)	.05	.85 (.29)	.00	1.09 (.32)	.00	.71 (.27)	.01

Note. References are [a] White, [b] high school graduate, [c] general course of study, [d] no participation in cooperative program, and [e] no possession of training certificate. Dotted line stands for a unit entered in the bivariate logistic regression equation. [d] Other school-to-work programs were not significant and are not presented in the table.

the senior year of high school was not related to job-education match in the bivariate analyses. Comprehensive courses in high school were positively associated with job-education match in the bivariate analysis of the 2003 wave and 2005 wave data (p = .05 & p =.04, respectively). Among school-to-work programs, only cooperative programs were significantly associated with job-education match and their association increased along with waves. Employment in high school was positively associated with job-education match in the bivariate analysis of data for waves 2005 and 2006. Self-esteem and a training certificate were positively related to job-education match across waves, but cognitive ability was negatively associated with job-education match across waves. Other variables, except for parental support which was not significant in the bivariate logistic analysis, were subjected to multivariate analysis.

4.2.2 Results of Multivariate Binary Logistic Regression for Factors Related to Job-Education Match

Tables 4.4–4.7 report the results for multivariate logistic regression analyses predicting job-education match with transition-related variables. In all analyses, the same set of covariates and independent variables were entered. To evaluate the extent to which variables contribute to job-education match, covariates and predictors were entered hierarchically; variables related to family background were entered first; experience in and out of high school were entered second; cognitive and noncognitive ability were then entered; and lastly; the effect of possession of a training certificate, which was obtained after entering the labor market, was tested.

In the analysis of the 2003 wave, the relationship between parental education less than high school and job-education match was close to significant (β = -.51, p = .09).

However, in the analysis of other subsequent waves, the relationship was not significant as respondents' work experience increased.

Comprehensive course of study was significant in the analysis of the 2003 and 2005 waves. However, after cooperative programs and employment in high school were entered into the model, the size and statistical significance of comprehensive programs were decreased considerably. This is because 60% of students who took comprehensive courses also took part in cooperative program and worked considerably more hours in a part-time job than students in other courses. In addition, the coefficient of comprehensive programs was influenced by self-esteem.

Participation in cooperative programs significantly accounted for job-education match in all analyses of waves. Employment in high school did not influence the effect of cooperative programs, which consist of work-based learning and require employment outside of school. However, their effect was slightly adjusted by self-esteem; participants in cooperative programs showed significantly higher self-esteem than did non-participants. In addition, to some extent cooperative programs' effect was influenced by a training certificate; participation in cooperative programs made it more likely for individuals to obtain a training certificate after high school graduation.

Hours worked in high school were only significant in the analysis of the 2005 wave; a one-thousand-hour increase in total number of work hours during high school enhanced the odds of a job-education match by 13%.

Self-esteem was strongly associated with job-education match. Its effect was significant in all waves except for the 2006 wave. The higher the self-esteem score was, the higher the odds of job-education match were. Cognitive ability was only significant in the analysis of the 2003 wave and was negatively related to job-education match, but in the analysis of the subsequent waves, its coefficient became positive, even though it was not significant.

Possession of a training certificate was strongly related to job-education match; the odds of a job-education match for formal training certificate were more than two times the odds found among non-holders, after holding constant other variables. As mentioned, a training certificate changed the effect of cooperative programs. Similarly, a training certificate decreased considerably the size and statistical significance of coefficients for work experience across waves. This reflects the tendency of more respondents to obtain a training certificate as work experience accumulates.

Table 4.4 Results of Logistic Regression between Job-Education Match and Transition-related Variables in 2003(Weighted)

	Model-1 (Parent ED)		Model-2 (Course)		Model-3 (Cooperative)		Model-4 (Employment)		Model-5 (Noncognitive)		Model-6 (Certificate)	
	β *(SE)*	*e^β* *(p)*	*β* *(SE)*	*e^β* *(p)*	*β* *(SE)*	*e^β* *(p)*	*β* *(SE)*	*e^β* *(p)*	*β* *(SE)*	*e^β* *(p)*	*β* *(SE)*	*e^β* *(p)*
Work exp	.45 (.12)	*1.59 (.00)*	.49 (.12)	*1.66 (.00)*	.48 (.12)	*1.65 (.00)*	.47 (.13)	*1.65 (.00)*	.45 (.14)	*1.57 (.00)*	.44 (.15)	*1.55 (.00)*
Black [a]	-.37 (.24)	*.60 (.06)*	-.39 (.25)	*.59 (.05)*	-.35 (.25)	*.63 (.09)*	-.30 (.26)	*.63 (.10)*	-.22 (.30)	*.80 (.46)*	-21 (.30)	*.80 (47)*
Hispanic [a]	.07 (.37)	*ns*	.15 (.38)	*ns*	.25 (.38)	*ns*	.29 (.39)	*ns*	.32 (.41)	*ns*	.32 (.42)	*ns*
Other-race [a]	.30 (.36)	*1.86 (.13)*	.43 (.38)	*2.32 (.06)*	.46 (.38)	*2.34 (.05)*	.49 (.39)	*2.33 (.06)*	.92 (.45)	*2.51 (.04)*	.91 (.45)	*2.49 (.04)*
Gender [b]	.04 (.21)	*ns*	.01 (.21)	*ns*	.01 (.22)	*ns*	-.02 (.22)	*ns*	-.02 (.24)	*ns*	-.01 (.24)	*ns*
< HS [c]	-.43 (.26)	*.63 (.11)*	-.46 (.26)	*.61 (.09)*	-.47 (.26)	*.58 (.06)*	-.47 (.26)	*.58 (.06)*	-.52 (.31)	*.60 (.09)*	-.51 (.30)	*.60 (.09)*
2Yr coll [c]	-.15 (.33)	*ns*	-.10 (.33)	*ns*	-.13 (.33)	*ns*	-.11 (.33)	*ns*	-.20 (.36)	*ns*	-.21 (.36)	*ns*
4Yr coll [c]	-.04 (.48)	*ns*	.05 (.48)	*ns*	.09 (.49)	*ns*	.12 (.49)	*ns*	.08 (.59)	*ns*	.09 (.59)	*ns*
Coll_prep [c]			-.03 (.31)	*ns*	-.05 (.32)	*ns*	-.08 (.32)	*ns*	-.38 (.38)	*ns*	-.38 (.36)	*ns*
Voca [c]			.46 (.34)	*ns*	.29 (.36)	*ns*	.28 (.36)	*ns*	.33 (.38)	*ns*	.31 (.38)	*ns*
Compre [c]			1.17 (.49)	*3.18 (.03)*	1.04 (.50)	*2.56 (.08)*	1.03 (.50)	*2.56 (.08)*	.84 (.58)	*2.31 (.15)*	.83 (.57)	*2.29 (.15)*
Other [c]			-1.26 (.89)	*ns*	-1.27 (.89)	*ns*	-1.22 (.89)	*ns*	-1.71 (.97)	*ns*	-1.69 (.97)	*ns*
Coop [d]					.84 (.29)	*2.31 (.01)*	.84 (.29)	*2.32 (.01)*	.81 (.33)	*2.25 (.02)*	.79 (.34)	*2.20 (.02)*
HS Emp							.03 (.05)	*1.00 (.96)*	-.01 (.04)	*.99 (.86)*	-.01 (.04)	*.99 (.88)*
Self-esteem									.37 (.18)	*1.45 (.04)*	.37 (.18)	*1.44 (.04)*
Cognitive									-.26 (.14)	*.77 (.06)*	-.26 (.14)	*.77 (.06)*
Certificate [e]											.16 (.33)	*1.17 (.62)*
Intercept	.03 (.26)		-.12 (.28)		-.22 (.28)		-.32 (.32)		-1.14 (.58)		-1.15 (.58)	
Model fit												
Wald χ^2	$\chi^2(8)=21.44$		$\chi^2(12)=32.01$,		$\chi^2(13)=37.35$,		$\chi^2(14)=37.76$,		$\chi^2(16)=39.71$,		$\chi^2(17)=40.86$,	
p	$p<.01$		$p<.01$		$p<.001$		$p<.001$		$p<.001$		$p<.001$	
- 2LL	*526*		*515*		*509*		*509*		*486*		*484*	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, and [e] no certificate.

Table 4.5 Results of Logistic Regression between Job-Education Match and Transition-related Variables in 2004 (Weighted)

	Model-1 (Parent ED)		Model-2 (Course)		Model-3 (Cooperative)		Model-4 (Employment)		Model-5 (Noncognitive)		Model-6 (Certificate)	
	β (SE)	*e^β (p)*	*β (SE)*	*e^β (p)*	*β (SE)*	*e^β (p)*	*β (SE)*	*e^β (p)*	*β (SE)*	*e^β (p)*	*β (SE)*	*e^β (p)*
Work exp	.33 (.15)	*1.39 (.02)*	.32 (.15)	*1.38 (.03)*	.31 (.15)	*1.36 (.04)*	.31 (.15)	*1.36 (.04)*	.27 (.16)	*1.30 (.10)*	.22 (.16)	*1.24 (.17)*
Cohort 2001	-.33 (.28)	*.68 (.17)*	-.33 (.28)	*ns*	-.32 (.29)	*ns*	-.32 (.29)	*ns*	-.26 (.28)	*ns*	-.23 (.28)	*ns*
Black [a]	-.44 (.28)	*ns*	-.44 (.27)	*ns*	-.39 (.28)	*ns*	-.35 (.29)	*ns*	-.25 (.30)	*ns*	-.21 (.30)	*ns*
Hispanic [a]	-.08 (.40)	*ns*	-.08 (.40)	*ns*	.05 (.40)	*ns*	.07 (.41)	*ns*	.14 (.41)	*ns*	.21 (.42)	*ns*
Other-race [a]	-.33 (.38)	*ns*	-.33 (.38)	*ns*	-.33 (.38)	*ns*	-.30 (.38)	*ns*	-.22 (.40)	*ns*	-.24 (.40)	*ns*
Gender [b]	.26 (.23)	*ns*	.26 (.23)	*ns*	.29 (.23)	*ns*	.28 (.24)	*ns*	.29 (.24)	*ns*	.33 (.24)	*ns*
< HS [c]	-.22 (.28)	*.81 (.46)*	-.22 (.28)	*.80 (.43)*	-.21 (.28)	*.81 (.47)*	-.20 (.29)	*.82 (.50)*	-.23 (.30)	*.80 (.45)*	-.22 (.31)	*.80 (.46)*
2Yr coll [c]	-.25 (.36)	*ns*	-.25 (.36)	*ns*	-.26 (.35)	*ns*	-.24 (.36)	*ns*	-.27 (.36)	*ns*	-.28 (.36)	*ns*
4Yr coll [c]	.60 (.60)	*ns*	.63 (.60)	*ns*	.69 (.60)	*ns*	.71 (.61)	*ns*	.55 (.64)	*ns*	.50 (.64)	*ns*
Coll_prep [c]			.28 (.37)	*ns*	.28 (.37)	*ns*	.26 (.37)	*ns*	.10 (.38)	*ns*	.10 (.39)	*ns*
Voca [c]			.28 (.36)	*ns*	.02 (.38)	*ns*	.01 (.38)	*ns*	.01 (.37)	*ns*	-.07 (.38)	*ns*
Compre [c]			.59 (.47)	*1.80 (.21)*	.34 (.47)	*1.41 (.47)*	.34 (.48)	*1.41 (.48)*	.16 (.49)	*1.17 (.75)*	.15 (.49)	*1.17 (.75)*
Other [c]			-1.43 (1.19)	*ns*	-1.32 (.1.17)	*ns*	-1.29 (1.17)	*ns*	-1.56 (1.31)	*ns*	-1.61 (1.17)	*ns*
Coop [d]					.83 (.32)	*2.31 (.01)*	.83 (.32)	*2.29 (.01)*	.77 (.32)	*2.15 (.02)*	.68 (.33)	*1.98 (.04)*
HS Emp							.02 (.05)	*1.41 (.47)*	.02 (.05)	*1.02 (.73)*	.02 (.05)	*1.03 (.60)*
Self-esteem									.51 (.19)	*1.68 (.01)*	.49 (.20)	*1.64 (.01)*
Cognitive									-.04 (.14)	*.96 (.80)*	-.04 (.15)	*.97 (.81)*
Certificate [e]											.68 (.31)	*1.98 (.03)*
Intercept	.19 (.36)		.09 (.37)		.78 (.31)		.69 (.37)		-.64 (.61)		-.83 (.62)	
Model fit												
Wald χ^2	$\chi^2(13)=17.53$		$\chi^2(13)=17.53$,		$\chi^2(14)=23.30$,		$\chi^2(15)=24.01$,		$\chi^2(17)=30.73$,		$\chi^2(18)=36.73$,	
p	$p=.13$		$p=.17$		$p=.05$		$p=.07$		$p<.02$		$p<.01$	
- 2LL	*510*		*507*		*498*		*498*		*488*		*482*	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, and [e] no certificate.

Table 4.6 Results of Logistic Regression between Job-Education Match and Transition-related Variables in 2005 (Weighted)

	Model-1 (Parent ED)		Model-2 (Course)		Model-3 (Cooperative)		Model-4 (Employment)		Model-5 (Noncognitive)		Model-6 (Certificate)	
	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*
Work exp	.27 (.14)	*1.31 (.06)*	.29 (.14)	*1.34 (.04)*	.27 (.15)	*1.31 (.06)*	.23 (.15)	*1.26 (.12)*	.22 (.16)	*1.25 (.16)*	.16 (.16)	*1.18 (.30)*
Cohort 2002	.37 (.27)	*ns*	.39 (.28)	*ns*	.38 (.28)	*ns*	.37 (.28)	*ns*	.25 (.29)	*ns*	.28 (.29)	*ns*
Black [a]	-.38 (.28)	*ns*	-.38 (.29)	*ns*	-.31 (.30)	*ns*	-.16 (.32)	*ns*	-.16 (.33)	*ns*	-.12 (.34)	*ns*
Hispanic [a]	-.34 (.43)	*ns*	-.40 (.44)	*ns*	-.27 (.44)	*ns*	-.17 (.46)	*ns*	-.17 (.41)	*ns*	-.10 (.48)	*ns*
Other-race [a]	-.37 (.41)	*ns*	-.34 (.42)	*ns*	-.32 (.42)	*ns*	-.22 (.43)	*ns*	-.15 (.46)	*ns*	.24 (.42)	*ns*
Gender [b]	.13 (.26)	*ns*	.07 (.26)	*ns*	.07 (.27)	*ns*	.02 (.27)	*ns*	.05 (.27)	*ns*	.12 (.27)	*ns*
< HS [c]	-.25 (.26)	*.78 (.41)*	-.28 (.31)	*.76 (.37)*	-.23 (.32)	*.79 (.47)*	-.19 (.33)	*.83 (.56)*	-.26 (.33)	*.77 (.44)*	-.24 (.34)	*.79 (.48)*
2Yr coll [c]	-.19 (.37)	*ns*	-.19 (.38)	*ns*	-.21 (.38)	*ns*	-.14 (.38)	*ns*	-.05 (.40)	*ns*	-.06 (.40)	*ns*
4Yr coll [c]	.19 (.60)	*ns*	.24 (.63)	*ns*	.28 (.66)	*ns*	.36 (.65)	*ns*	.33 (.66)	*ns*	.29 (.65)	*ns*
Coll_prep [c]			.38 (.43)	*ns*	.36 (.43)	*ns*	.31 (.44)	*ns*	.22 (.44)	*ns*	.21 (.43)	*ns*
Voca [c]			.17 (.39)	*ns*	-.12 (.42)	*ns*	-.18 (.41)	*ns*	-.25 (.42)	*ns*	-.47 (.44)	*ns*
Compre [c]			1.24 (.61)	*3.46 (.04)*	1.00 (.62)	*2.72 (.10)*	.97 (.62)	*2.64 (.12)*	.75 (.63)	*2.12 (.23)*	.76 (.63)	*2.13 (.23)*
Other [c]			-.70 (1.38)	*ns*	-.58 (1.36)	*ns*	-.50 (1.36)	*ns*	-.75 (1.61)	*ns*	-.93 (1.39)	*ns*
Coop [d]					.95 (.39)	*2.59 (.01)*	.94 (.39)	*2.56 (.01)*	.93 (.38)	*2.52 (.02)*	.83 (.38)	*2.29 (.03)*
HS Emp							.09 (.06)	*1.09 (.12)*	.11 (.06)	*1.12 (.06)*	.12 (.06)	*1.13 (.04)*
Self-esteem									.51 (.21)	*1.67 (.01)*	.48 (.21)	*1.62 (.02)*
Cognitive									.21 (.16)	*1.23 (.19)*	.23 (.16)	*1.26 (.15)*
Certificate [e]											1.06 (.34)	*2.87 (.01)*
Intercept	.10 (.41)		-.15 (.43)		-.41 (.47)		-.21 (.45)		-1.39 (.68)		-1.42 (.67)	
Model fit												
Wald χ^2	$\chi^2(9)=8.59$		$\chi^2(13)=12.95$,		$\chi^2(14)=18.49$,		$\chi^2(15)=23.14$,		$\chi^2(17)=29.44$,		$\chi^2(18)=38.08$,	
p	$p=.48$		$p=.45$		$p=.18$		$p=.08$		$p<.05$		$p<.01$	
- 2LL	*444*		*438*		*428*		*426*		*418*		*406*	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, and [e] no certificate.

Table 4.7 Results of Logistic Regression between Job-Education Match and Transition-related Variables in 2006 (Weighted)

	Model-1 (Parent ED)		Model-2 (Course)		Model-3 (Cooperative)		Model-4 (Employment)		Model-5 (Noncognitive)		Model-6 (Certificate)	
	β	e^{β}	β	e^{β}	β	e^{β}	β	e^{β}	β	e^{β}	β	e^{β}
	(SE)	*(p)*	*(SE)*	*(p)*	*(SE)*	*(p)*	*(SE)*	*(p)*	*(SE)*	*(p)*	*(SE)*	*(p)*
Work exp	.36	*1.43*	.37	*1.45*	.37	*1.45*	.35	*1.42*	.32	*1.38*	.37	*1.45*
	(.13)	*(.01)*	(.14)	*(.01)*	(.14)	*(.01)*	(.14)	*(.02)*	(.15)	*(.03)*	(.19)	*(.06)*
Class 2002	.43	*1.54*	.44	*1.55*	.45	*1.56*	.44	*1.55*	.42	*1.59*	-.49	*1.54*
	(.26)	*(.09)*	(.26)	*(.09)*	(.26)	*(.09)*	(.26)	*(.10)*	(.27)	*(.12)*	(.33)	*(.11)*
Black [a]	-.21	*ns*	-.23	*ns*	-.11	*ns*	-.01	*ns*	.09	*ns*	.09	*ns*
	(.28)		(.28)		(.29)		(.30)		(.31)		(.33)	
Hispanic [a]	-.07	*ns*	-.09	*ns*	.08	*ns*	.13	*ns*	.20	*ns*	.25	*ns*
	(.40)		(.40)		(.41)		(.42)		(.42)		(.43)	
Other-race [a]	-.64	*.52*	-.67	*.51*	-.66	*.51*	-.58	*.56*	-.56	*.57*	-.66	*.51*
	(.37)	*(.08)*	(.38)	*(.08)*	(.38)	*(.08)*	(.39)	*(.13)*	(.39)	*(.15)*	(.38)	*(.04)*
Gender [b]	.39	*1.48*	.36	*1.43*	.36	*1.46*	.35	*1.42*	.37	*1.44*	.46	*1.54*
	(.24)	*(.10)*	(.24)	*(.14)*	(.25)	*(.12)*	(.25)	*(.15)*	(.25)	*(.14)*	(.24)	*(.08)*
< HS [c]	-.39	*.67*	-.42	*.66*	-.41	*.66*	-.39	*.68*	-.39	*.68*	-.40	*.66*
	(.30)	*(.19)*	(.30)	*(.16)*	(.31)	*(.18)*	(.31)	*(.20)*	(.31)	*(.21)*	(.31)	*(.19)*
2Yr coll [c]	-.74	*.48*	-.72	*.49*	-.73	*.48*	-.68	*.50*	-.67	*.51*	-.71	*.49*
	(.33)	*(.02)*	(.33)	*(.03)*	(.33)	*(.03)*	(.34)	*(.04)*	(.34)	*(.04)*	(.34)	*(.04)*
4Yr coll [c]	-.29	*ns*	-.33	*ns*	-.20	*ns*	-.13	*ns*	-.17	*ns*	-.17	*ns*
	(.32)		(.50)		(.52)		(.52)		(.54)		(.54)	
Coll_prep [c]			.25	*ns*	.19	*ns*	.16	*ns*	.07	*ns*	.04	*ns*
			(.38)		(.37)		(.38)		(.39)		(.40)	
Voca [c]			.20	*ns*	-.11	*ns*	-.15	*ns*	-.14	*ns*	-.22	*ns*
			(.37)		(.39)		(.39)		(.38)		(.38)	
Compre [c]			.61	*1.28*	.29	*1.34*	.28	*1.33*	.21	*1.24*	.19	*1.30*
			(.51)	*(.51)*	(.51)	*(.56)*	(.50)	*(.57)*	(.52)	*(.68)*	(.53)	*(.61)*
Other [c]			.53	*ns*	.66	. *ns*	.75	*ns*	.59	*ns*	.76	*ns*
			(1.63)		(1.62)		(1.64)		(1.65)		(1.65)	
Coop [d]					1.27	*3.56*	1.26	*3.52*	1.23	*3.42*	1.09	*2.97*
					(.40)	*(.00)*	(.40)	*(.00)*	(.40)	*(.00)*	(.41)	*(.01)*
HS Emp							.07	*1.06*	.07	*1.07*	.08	*1.07*
							(.05)	*(.22)*	(.05)	*(.22)*	(.06)	*(.22)*
Self-esteem									.21	*1.23*	.19	*1.19*
									(.18)	*(.26)*	(.18)	*(.36)*
Cognitive									-.06	*.94*	-.05	*.94*
									(.14)	*(.65)*	(.14)	*(.67)*
Certificate [e]											.72	*2.05*
											(.28)	*(.01)*
Intercept	-.63		-.77		-.97		-1.16		-1.59		-1.59	
	(.66)		(.67)		(.70)		(.72)		(.85)		(.82)	
Model fit												
Wald χ^2	χ^2*(10) =24.17*		χ^2*(13)=26.31,*		χ^2*(14) =34.79,*		χ^2*(15) =35.49,*		χ^2*(17) =39.98,*		χ^2*(18)=40.99,*	
p	*p* <.01		*p* <.01		*p* <.01		*p* <.01		*p* <.01		*p* <.01	
- 2LL	*490*		*486*		*472*		*468*		*466*		*460*	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, and [e] no certificate.

4.2.4 Results of Multivariate Ordinal Logistic Regression for Factors Related to Ordered Job Categories

Job Zone hierarchies in O'NET, which are characteristic of the five ordered categories from one to five, were regressed on transition-related variables by using ordinal logistic regression to examine whether these transition-related variables contributed to individual workers' ability to climb the career ladder in addition to contributing to the binary job-education match. Tests for proportional odds assumption or parallel regression assumption (SPSS, 2006; UCLA Academic Technology Services, n.d.), i.e., the equal relationship between log odds for each category in the dependent and independent variables, showed that each model for the cross-sectional waves did not violate this assumption; for the 2003 wave, $\chi^2(30) = 35$, $p = .26$; for the 2002wave, $\chi^2(30) = 20$, $p = .91$; for the 2001wave, $\chi^2(39) = 30$, $p = .12$; for the 2000wave, $\chi^2(30) = .09$, $p = .98$. Therefore, one coefficient can describe the relationship between each category of dependent variables and a predictor[5].

The dependent variable was restricted to Job Zone categories 1–4; category 5 was excluded from the analysis using ordinal logistic regression due to small sample size ($n < 3$). Table 4.8 reports the results of saturated models applying ordinal logistic regression to the data for each cross-sectional wave, whereas Table 4.9 shows the results of saturated models applying binary logistic regression for the same set of covariates and predictors. Cohort membership representing work experience shows that if a worker belongs to an old cohort, the logged odds of getting a higher-ordered job in the Job Zone hierarchy increased. Obtaining a training certificate was also associated with a tendency to be employed in a higher-ordered job in the Job Zone hierarchy. Unlike the results of the

[5] Multinomial logistic regression for *n* categories of dependent variable produces *n-1* coefficients for each predictor, whereas ordinal logistic regression produces only one coefficient.

binary logistic regression as shown in Table 4.9, parental education's effect on the analysis of the ordinal logistic regression was consistently significant across waves. If a respondent's parents had less than a high school education, the ordered log odds for a worker to obtain a one degree higher ordered job in the Job Zone hierarchy decreased by .77; this meant that the probability of getting a higher-status job decreased for workers whose parents had less than a high school education. Likewise, cooperative programs showed a significant and consistent effect on the ordered log odds of obtaining a higher-status job. Employment in high school was positively associated with a higher-ordered job in the 2005 and 2006 waves. Self-esteem was also positively related to a higher-status job with the exception of the 2006 wave. Results from the ordinal logistic regression were very similar to those from the binary logistic regression except for the effect of parent education on the job-education match.

Table 4.8 Results of Ordinal Logistic Regression for Job-Education Match by Cross-Sectional Years

	2003		2004		2005		2006	
Variable	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*
Cohort 2000 [a]	1.40 (.46)	4.06 (.00)	.69 (.41)	*ns*	.58 (.44)	*ns*	1.15 (.43)	3.14 (.01)
Cohort 2001 [a]	1.15 (.32)	3.16 (.00)	.26 (.31)	*ns*	.48 (.32)	*ns*	.46 (.34)	*ns*
Cohort 2002 [a]	.60 (.30)	1.81 (.04)	.11 (.30)	*ns*	.43 (.31)	*ns*	.51 (.32)	*ns*
Training [b]	.14 (.29)	*ns*	.43 (.24)	1.54 (.03)	.83 (.25)	2.29 (.00)	.77 (.23)	2.16 (.01)
Black [c]	-.22 (.29)	*ns*	-.01 (.29)	*ns*	.08 (.28)	*ns*	.07 (.26)	*ns*
Hispanic [c]	.30 (.36)	*ns*	.21 (.38)	*ns*	-.02 (.47)	*ns*	.05 (.33)	*ns*
Other_race [c]	1.03 (.39)	1.35 (.01)	.04 (.43)	*ns*	.11 (.38)	*ns*	-.31 (.34)	*ns*
Gender [d]	-.22 (.22)	*ns*	.17 (.21)	*ns*	.18 (.22)	*ns*	.38 (.21)	1.46 (.07)
Less than HS [e]	-.77 (.26)	.46 (.00)	-.49 (.27)	.61 (.07)	-.61 (.25)	.54 (.02)	-.59 (.25)	.56 (.02)
2Yr college [e]	-.46 (.31)	*ns*	-.47 (.34)	*ns*	-.49 (.33)	*ns*	-.92 (.32)	.39 (.01)
4Yr college [e]	.15 (.49)	*ns*	.12 (.44)	*ns*	.06 (.44)	*ns*	.16 (.45)	*ns*
College_prep [f]	-.33 (.34)	*ns*	.10 (.38)	*ns*	.43 (.41)	*ns*	.14 (.35)	*ns*
Vocational [f]	.47 (.34)	*ns*	.24 (.27)	*ns*	-.37 (.32)	*ns*	-.12 (.29)	*ns*
Comprehensive [f]	.46 (.34)	*ns*	-.03 (.38)	*ns*	.50 (.37)	*ns*	-.18 (.36)	*ns*
Other [f]	-1.85 (.81)	.16 (.02)	-.90 (2.14)	*ns*	.05 (1.46)	*ns*	.89 (1.23)	*ns*
Cooperative [g]	.69 (.25)	1.99 (.01)	.52 (.23)	1.69 (.02)	.44 (.26)	1.55 (.09)	.75 (.26)	2.12 (.00)
Emp in HS	.03 (.04)	*ns*	.04 (.04)	*ns*	.08 (.04)	1.09 (.04)	.09 (.04)	1.09 (.03)
Self-esteem	.25 (.18)	1.52 (.03)	.40 (.17)	1.49 (.02)	.28 (.16)	1.33 (.07)	.11 (.14)	*ns*
Threshold								
Job zone1	.58 (.57)		1.03 (.57)		.64 (.67)		.76 (.70)	
Job zone2	2.86 (.60)		3.30 (.59)		3.18 (.64)		3.18 (.73)	
Job zone3	5.18 (.68)		5.17 (.62)		5.52 (.76)		5.60 (.80)	
Model fit								
Wald χ^2	$\chi^2(18)= 59.20$		$\chi^2(18)= 38.89$		$\chi^2(18)= 58.77$		$\chi^2(18)= 69.93$	
p	$p < .001$		$p < .01$		$p < .001$		$p < .001$	
-2LL	*847*		*928*		*882*		*921*	

Note. References are [a] Class 2003, [b] no training certificate, [c] White, [d] female, [e] high school graduate, [f] course of study, and [g] no participation in cooperative program, respectively.

Table 4.9 Results of Logistic Regression for Job-Education Match (Saturated Model), by Cross-Sectional Years (Weighted)

	2003		2004		2005		2006	
Variable	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*	β *(SE)*	e^{β} *(p)*
Class 2000 [a]	1.39 (.51)	4.01 (.01)	.68 (.48)	*ns*	.41 (.54)	*ns*	1.10 (.53)	3.00 (.04)
Class 2001 [a]	1.13 (.35)	3.10 (.00)	.18 (.35)	*ns*	.28 (.37)	*ns*	.44 (.36)	*ns*
Class 2002 [a]	.68 (.33)	1.97 (.00)	.15 (.35)	*ns*	.46 (.38)	*ns*	.66 (.35)	1.93 (.06)
Training [b]	.17 (.34)	*ns*	.67 (.31)	1.95 (.03)	1.04 (.34)	2.82 (.00)	.73 (.29)	2.08 (.01)
Black [c]	-.34 (.29)	*ns*	-.22 (.29)	1.95 (.03)	-.00 (.32)	*ns*	.08 (.30)	*ns*
Hispanic [c]	.26 (.41)	*ns*	.20 (.42)	*ns*	-.04 (.47)	*ns*	.24 (.44)	*ns*
Other_race [c]	.96 (.45)	*ns*	-.20 (.40)	*ns*	-.27 (.42)	*ns*	-.63 (.39)	*ns*
Gender [d]	-.02 (.24)	*ns*	.33 (.24)	*ns*	.11 (.27)	*ns*	.45 (.25)	*ns*
Less than HS [e]	-.57 (.30)	.57 (.06)	-.23 (.31)	*ns*	-.20 (.34)	*ns*	-.42 (.31)	*ns*
2Yr college [e]	-.17 (.37)	*ns*	-.28 (.36)	*ns*	-.10 (.39)	*ns*	-.69 (.34)	.50 (.04)
4Yr college [e]	.15 (.56)	*ns*	.54 (.65)	*ns*	.24 (.66)	*ns*	-.15 (.54)	*ns*
College_prep [f]	-.31 (.35)	*ns*	.11 (.39)	*ns*	.16 (.43)	*ns*	.07 (.39)	*ns*
Vocational [f]	.22 (.39)	*ns*	-.09 (.39)	*ns*	-.37 (.43)	*ns*	-.23 (.38)	*ns*
Comprehensive [f]	.83 (.56)	2.30 (.14)	.14 (.48)	*ns*	.81 (.63)	*ns*	.21 (.52)	*ns*
Other [f]	-1.76 (.93)	.17 (.06)	-1.39 (1.33)	*ns*	-.89 (1.46)	*ns*	.67 (1.62)	*ns*
Cooperative [g]	.81 (.33)	2.24 (.02)	.68 (.33)	1.97 (.04)	.79 (.39)	2.20 (.04)	1.10 (.41)	3.02 (.01)
Emp in HS	-.00 (.04)	*ns*	.03 (.05)	*ns*	.11 (.06)	1.11 (.08)	.08 (.06)	1.07 (.17)
Self-esteem	.42 (.18)	1.52 (.03)	.50 (.01)	1.65 (.01)	.40 (.20)	1.50 (.04)	.19 (.18)	*ns*
Intercept	-4.64 (1.31)		-3.26 (1.30)		-2.18 (1.35)		-2.91 (1.30)	
Model fit								
Wald χ^2	$\chi^2(18)= 38.87$		$\chi^2(18)= 35.97$		$\chi^2(18)= 36.67$		$\chi^2(18)= 43.77$	
p	$p <.01$		$p < .01$		$p <.01$		$p <.001$	
-2LL	*488*		*482*		*408*		*459*	

Note. References are [a] Class 2003, [b] no training certificate, [c] White, [d] female, [e] high school graduate, [f] course of study, and [g] no participation in cooperative program, respectively.

4.3 Cross-Sectional Study of the Relationship between Log Hourly Wage Rates and Transition-related Variables and Job-Education Match

This section includes results from the cross-sectional analysis of factors related to log hourly wage rates. First, patterns of log hourly wage rates by cross-sectional waves are presented. Then, results of a multiple regression on the relationship between log hourly wage rates and transition-related variables are presented. Then, changes that occurred in the relationship when job-education match was incoporated into the model are reported.

4.3.1 Trajectory of Log Hourly Wage Rates and Identification of Cohort Difference

Table 4.10 and Figure 4.2 illustrate that mean log hourly wage rates within the same wave are strongly related to number of years of work experience after high school graduation. Trajectories of mean log hourly wage rates are slightly bent toward the axis for work experience rather than a sheer linear line, indicative of a cohort effect. However, when log hourly wage rates were regressed on work experience and cohort dummies, all dummy variables were insignificant or dropped from the model due to multicollinearity with work experience. The test results are presented in the first row of Table 4.11. Furthermore, adjusted R^2 values were higher in models incorporating only work experience than models in which work experience and cohort membership were combined. Therefore, models specified with only work experience fit better into the model, implying a linear relationship between log hourly wage rates and work experience. Meanwhile, a visual examination suggests that the trajectory lines for later waves were located slightly higher than those for early waves, but ANOVA tests revealed no difference in the mean log wage rates between waves at the same years of work experience; this is suggestive of a no period effect.

Table 4.10 Mean Log Hourly Wage Rates (Weighted), by Cross-Sectional Waves and Years after High School Graduation

		Years after high school graduation						
	n[a]	0	1	2	3	4	5	6
Mean log wage rates		6.47	6.54	6.77	6.90	6.96	7.10	7.18
Cross sectional wave								
2003	412	6.47	6.62	6.74	6.89			
2004	415		6.64	6.78	6.86	6.91		
2005	408			6.79	6.94	7.00	7.10	
2006	441				6.91	6.97	7.10	7.18
Cohort (Class)					Class 2003	Class 2002	Class 2001	Class 2000

Note. [a] Average unweighted observations across years after high school graduation. Cohort memberships are indicated by cell shading.

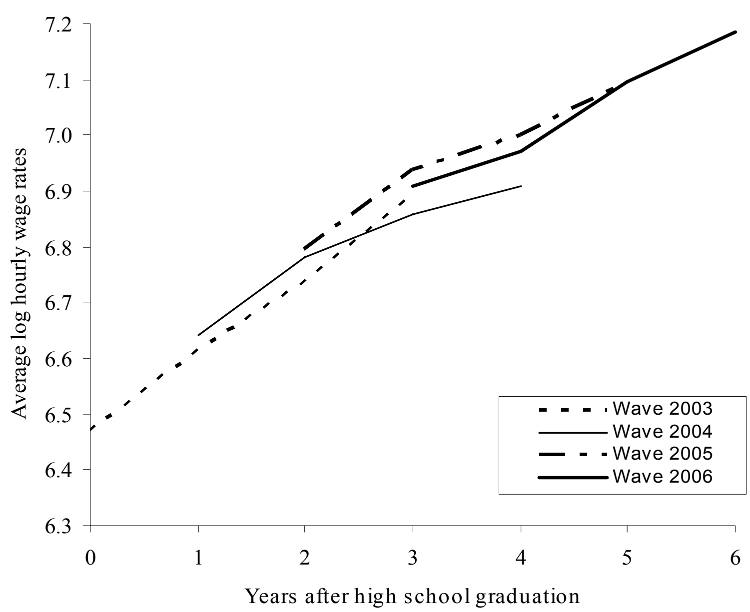

Figure 4.2 Trajectories of average log hourly wage rates

Note. Wage rates: Measured in Cents

4.3.2 Results of the Bivariate Regression for Factors Related to Log Hourly Wage Rates

Table 4.11 presents the results of the bivariate regression analyses by cross-sectional waves. As mentioned earlier, number of years of work experience after high school graduation was positively associated with log hourly wage rates; a one-year increase in work experience enhanced hourly wage rates by 9%-14%. Being Black had a 6%-17% disadvantage for hourly wage rates compared to those for White workers, but was not significant in the 2005 wave. The estimated average male-female gap in hourly wage rates was 9% to 29%. Young workers whose parents had less than a high school education were at a considerable disadvantage in hourly wage rates; their hourly wage rates ranged from 14% to 19%. Parental support in the senior year of high school was not related to log hourly wage rates in the bivariate analyses. Course of study in high school was not significantly associated with log hourly wage rates across waves. Among school-to-work programs, only cooperative programs were significantly associated with log hourly wage rates and only in the 2006 wave. Employment in high school was positively associated with hourly wage rates across all waves; 1,000 hours worked during high school increased one's hourly wage rates by 3–5%. Self-esteem was positively related to hourly wage rates in the 2003 wave, but standardized cognitive ability was negatively associated with log hourly wage rates across waves; an increase in one standard deviation decreased hourly wage rates by 8%-14%. Job-education match had a significantly positive association with log hourly wage rates; obtaining a job equivalent to high school education increased hourly wage rates by 18%-26%. Variables such as parental support and course of study in high school, which were not significant in the bivariate regression analysis, were not subjected to multivariate analysis.

Table 4.11 Results of the Bivariate Linear Regression between Log Hourly Wage Rates and Potential Predictors, by Cross-Sectional Years

	2003		2004		2005		2006	
Dependent variable	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Work experience	.14 (.03)	.00	.09 (.03)	.00	.09 (.03)	.00	.10 (.03)	.00
Black [a]	-.15 (.07)	.04	-.12 (.06)	.04	-.06 (.07)	.41	-.17 (.06)	.01
Hispanic [a]	-.13 (.07)	.06	-.09 (.07)	.21	.08 (.17)	.62	.16 (.19)	.42
Other-race [a]	.02 (.15)	.88	-.07 (.09)	.36	-.12 (.16)	.48	-.05 (.08)	.54
Gender	.19 (.06)	.00	.29 (.05)	.00	.18 (.07)	.01	.09 (.06)	.15
Less than HS [b]	-.19 (.09)	.04	-.18 (.07)	.01	-.16 (.08)	.06	-.14 (.08)	.07
2Yr college [b]	-.10 (.10)	.32	-.07 (.07)	.28	-.06 (.17)	.69	-.06 (.07)	.41
4Yr college [b]	.02 (.17)	.94	-.05 (.19)	.80	.26 (.19)	.18	.02 (.09)	.82
Parental support	-.00 (.06)	.99	.01 (.06)	.83	-.14 (.09)	.11	-.05 (.05)	.37
College_prep [c]	-.03 (.22)	.79	-.01 (.10)	.96	.10 (.22)	.65	.02 (.07)	.80
Vocational [c]	-.08 (.08)	.33	.05 (.08)	.65	-.02 (.08)	.80	-.06 (.19)	.75
Comprehensive [c]	-.03 (.11)	.80	.05 (.07)	.51	.06 (.06)	.31	.06 (.07)	.44
Other_course [c]	.48 (.39)	.22	.01 (.15)	.97	1.80 (.86)	.04	-.41 (.40)	.31
Cooperative program [d]	.08 (.06)	.20	.10 (.06)	.13	.10 (.08)	.21	.21 (.07)	.00
HS employment	.04 (.01)	.00	.05 (.01)	.00	.03 (.02)	.03	.03 (.01)	.00
Self-esteem	.09 (.04)	.04	.11 (.04)	.00	.02 (.04)	.70	.03 (.05)	.57
Cognitive	-.14 (.04)	.00	-.08 (.03)	.00	-.08 (.04)	.06	-.12 (.03)	.00
Training certificate [e]	.06 (.06)	.38	.14 (.06)	.02	.09 (.07)	.18	.13 (.08)	.10
Job-education match [f]	.26 (.06)	.00	.18 (.05)	.00	.26 (.07)	.00	.22 (.06)	.00

Note. References are [a] White, [b] high school graduate, [c] general course of study, [d] no participation in cooperative program, [e] no possession of training certificate, and [f] not matched. Dotted line stands for a unit entered in a bivariate regression equation. [d] Other school-to-work programs were not significant and are not presented in the table.

4.3.3 Results from the Multivariate Regression for Factors Related to Log Hourly Wage Rates

Tables 4.12–4.15 present the results for the multivariate regression analysis predicting log hourly wage rates with transition-related variables. In all analyses, the same set of control variables and predictors were entered. To evaluate the degree to which each factor contributed to log hourly wage rates, each factor was entered hierarchically; first, family factors were entered; then, high school experience; then, cognitive and noncognitive ability; and lastly, events after high school graduation, a training certificate and job-education match.

Parent education less than high school had a significantly negative relationship with children's wage rates. This negative relationship was decreased considerably by high school experience, such as participation in cooperative programs and employment in high school, cognitive ability and job-education match. When participation in cooperative programs and employment in high school were entered into the analysis, only cooperative programs significantly accounted for log hourly wage rates in all analyses except the 2006 wave. This suggests an overlap in the association between participation in cooperative programs and employment in high school and hourly wage rates. The relationship between employment in high school and log wage rates was consistent across waves but substantially decreased when job-education match was entered in the model.

The effects of self-esteem on log hourly wage rates were significant only in the analyses of the 2003 and 2004 waves. This effect was also considerably decreased by job-education match. Meanwhile, controlling for cognitive ability changed significantly the effect of being Black, having parents who did not complete high school, and employment in high school on hourly wage rates, implying that the negative association with log hourly wage rates was due to low cognitive ability. In contrast, cognitive ability was negatively related to log hourly wage rates, even after controlling for all other variables. The negative association between cognitive ability and log hourly wage rates tended to become stronger when job-education match was controlled.

When a training certificate was entered, the coefficients and statistical significance of other variables did not change except for those for work experience. The statistical significance of work experience was decreased considerably by a training certificate across waves. Entering job-education match into a model decreased considerably the statistical significance and size of coefficients for parental education less than high school, work experience, cooperative program, employment in high school, self-esteem and a training certificate. In addition, the R^2 value was enhanced by entering job-education match into the regression model, with the exception of the 2006 wave. This suggests that although there may be, to some extent, a direct effect of transition-related variables on hourly wage rates, to a large extent an indirect effect of transition-related variables was mediated through job-education match. To determine the relative importance of variables in the model, the Best Subset Method was applied in the analyses for Model 6 and all waves. The purpose of this procedure was to explore which transition-related variables could be removed without reducing model predictability, given that the effects of transition-related variables were linked through job-education match. The Best Subsets, the shaded rows in Table 4.16, identify models that simultaneously maximize the adjusted R^2 value and minimize the squared error of the fitted model (*Cp*). Most subsets include job-education match, work-experience, cognitive ability, and employment in high school. This implies that the effects of other transition-related variables were considerably linked through job-education match.

Table 4.12 Results of Log Hourly Wage Rates Regressed on Transition-related Variables in 2003 (Weighted)

	Model-1 (Parental ED)		Model-2 (Employment)		Model-3 (Self-esteem)		Model-4 (Cognitive)		Model-5 (Certificate)		Model-6 (Match)	
	β *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Work exp	.14 (.03)	.00	.13 (.04)	.00	.13 (.04)	.00	.11 (.04)	.00	.11 (.04)	.00	.11 (.04)	.00
Black [a]	-.14 (.07)	.06	-.11 (.08)	.17	-.09 (.08)	.26	-.03 (.08)	.73	-.03 (.08)	.74	.06 (.08)	.48
Hispanic [a]	-.09 (.07)	*ns*	-.06 (.07)	*ns*	-.04 (.08)	*ns*	-.02 (.07)	*ns*	-.04 (.07)	*ns*	-.02 (.08)	*ns*
Other-race [a]	.10 (.15)	*ns*	.13 (.15)	*ns*	.14 (.15)	*ns*	.13 (.15)	*ns*	.13 (.15)	*ns*	.20 (.14)	*ns*
Gender [b]	.18 (.06)	.00	.17 (.06)	.01	.17 (.06)	.01	.18 (.06)	.00	.18 (.06)	.00	.16 (.06)	.01
Less than HS [c]	-.17 (.10)	.08	-.16 (.10)	.10	-.16 (.10)	.09	-.15 (.09)	.11	-.15 (.09)	.11	-.11 (.10)	.24
2Yr college [c]	-.09 (.09)	*ns*	-.07 (.09)	*ns*	-.07 (.09)	*ns*	-.09 (.09)	*ns*	-.09 (.09)	*ns*	-.04 (.09)	*ns*
4Yr college [c]	.01 (.15)	*ns*	.04 (.15)	*ns*	.03 (.15)	*ns*	.02 (.16)	*ns*	.02 (.15)	*ns*	.03 (.19)	*ns*
Cooperative[d]			.05 (.06)	.44	.03 (.06)	.60	.04 (.06)	.52	.04 (.06)	.52	.00 (.06)	.99
HS employment			.02 (.01)	.08	.03 (.01)	.07	.02 (.01)	.09	.02 (.01)	.10	.02 (.01)	.16
Self-esteem					.08 (.04)	.04	.05 (.04)	.17	.05 (.04)	.17	.05 (.04)	.22
Cognitive							-.10 (.04)	.00	-.10 (.04)	.01	-.10 (.04)	.01
Certificate [e]									.01 (.06)	.93	-.01 (.07)	.89
Match [f]											.16 (.06)	.01
Intercept	6.57 (.05)	.00	6.32 (.09)	.00	6.10 (.14)	.00	6.19 (.13)	.00	6.18 (.14)	.00	6.10 (.14)	.00
Model fit	$F(8,466)=5.53$, $p<.001$		$F(10,395)=4.04$, $p<.001$		$F(11,394)=5.15$, $p<.001$		$F(12,393)=5.15$, $p<.001$		$F(13,392)=4.69$, $p<.001$		$F(14,348)=5.48$, $p<.001$	
	$R^2=.08$		$R^2=.09$		$R^2=.10$		$R^2=.13$		$R^2=.13$		$R^2=.15$	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, [e] no certificate, and [f] not matched.

Table 4.13 Results of Log Hourly Wage Rates Regressed on Transition-related Variables in 2004 (Weighted)

	Model-1 (Parental ED)		Model-2 (Employment)		Model-3 (Self-esteem)		Model-4 (Cognitive)		Model-5 (Certificate)		Model-6 (Match)	
	β *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Work exp	.09 (.03)	.01	.08 (.03)	.01	.08 (.03)	.01	.07 (.03)	.03	.06 (.03)	.07	.06 (.03)	.06
Black [a]	-.10 (.07)	.04	-.05 (.06)	.38	-.04 (.06)	.53	-.03 (.06)	.63	-.02 (.06)	.76	.02 (.06)	.75
Hispanic [a]	-.04 (.17)	*ns*	.01 (.07)	*ns*	.02 (.07)	*ns*	.02 (.07)	*ns*	.03 (.07)	*ns*	.02 (.07)	*ns*
Other-race [a]	.01 (.18)	*ns*	.03 (.08)	*ns*	.04 (.08)	*ns*	-.04 (.08)	*ns*	-.04 (.08)	*ns*	.04 (.09)	*ns*
Gender [b]	.28 (.05)	.00	.26 (.05)	.00	.26 (.07)	.00	.26 (.07)	.00	.27 (.05)	.00	.24 (.06)	.00
Less than HS [c]	-.13 (.07)	.08	-.10 (.07)	.15	-.11 (.07)	.10	-.11 (.07)	.12	-.10 (.07)	.12	-.18 (.07)	.24
2Yr college [c]	.03 (.06)	*ns*	-.00 (.07)	*ns*	-.00 (.07)	*ns*	-.01 (.07)	*ns*	-.01 (.06)	*ns*	.03 (.07)	*ns*
4Yr college [c]	-.03 (.17)	*ns*	.01 (.16)	*ns*	-.01 (.16)	*ns*	-.01 (.17)	*ns*	-.00 (.17)	*ns*	-.10 (.19)	*ns*
Cooperative[d]			.06 (.08)	.34	.04 (.06)	.51	.04 (.06)	.48	.02 (.06)	.75	-.01 (.06)	.91
HS employment			.03 (.02)	.01	.03 (.01)	.02	.03 (.01)	.02	.03 (.01)	.02	.04 (.01)	.01
Self-esteem					.09 (.03)	.01	.08 (.03)	.02	.08 (.03)	.02	.06 (.04)	.09
Cognitive							-.03 (.03)	.28	-.03 (.01)	.27	-.05 (.03)	.10
Certificate [e]									.14 (.06)	.01	.10 (.06)	.06
Match [f]											.09 (.06)	.11
Intercept	6.47 (.07)	.00	6.34 (.09)	.00	6.43 (.13)	.00	6.15 (.14)	.00	6.13 (.14)	.00	6.11 (.15)	.00
Model fit	$F(8,401)=9.08$, $p<.001$ $R^2=.12$		$F(10,398)=7.78$, $p<.001$ $R^2=.15$		$F(11,397)=8.00$, $p<.001$ $R^2=.16$		$F(12,396)=7.92$, $p<.001$ $R^2=.16$		$F(13,395)=7.40$, $p<.001$ $R^2=.18$		$F(14,350)=7.55$, $p<.001$ $R^2=.19$	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, [e] no certificate, and [f] not matched.

Table 4.14 Results of Log Hourly Wage Rates Regressed on Transition-related Variables in 2005 (Weighted)

	Model-1 (Parental ED)		Model-2 (Employment)		Model-3 (Self-esteem)		Model-4 (Cognitive)		Model-5 (Certificate)		Model-6 (Match)	
	β *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Work exp	.10 (.03)	.01	.08 (.03)	.01	.08 (.03)	.01	.07 (.03)	.03	.06 (.04)	.07	.07 (.04)	.09
Black [a]	-.05 (.07)	.52	.00 (.07)	.99	.00 (.07)	.97	.03 (.08)	.74	.03 (.08)	.69	.05 (.08)	.52
Hispanic [a]	.09 (.17)	*ns*	.14 (.17)	*ns*	.14 (.17)	*ns*	.15 (.17)	*ns*	.16 (.17)	*ns*	.07 (.13)	*ns*
Other-race [a]	-.05 (.17)	*ns*	-.03 (.18)	*ns*	-.03 (.18)	*ns*	-.04 (.18)	*ns*	-.04 (.18)	*ns*	-.06 (.21)	*ns*
Gender [b]	.18 (.07)	.02	.16 (.07)	.03	.16 (.07)	.03	.16 (.07)	.03	.16 (.07)	.02	.13 (.08)	.08
Less than HS [c]	-.11 (.09)	.21	.10 (.09)	.26	-.10 (.09)	.26	-.09 (.08)	.29	-.09 (.09)	.29	-.07 (.10)	.49
2Yr college [c]	.10 (.17)	*ns*	.12 (.18)	*ns*	.12 (.18)	*ns*	.11 (.17)	*ns*	.11 (.18)	*ns*	.15 (.19)	*ns*
4Yr college [c]	.27 (.20)	*ns*	.30 (.20)	*ns*	.30 (.20)	*ns*	.30 (.20)	*ns*	.30 (.20)	*ns*	.20 (.22)	*ns*
Cooperative[d]			.06 (.08)	.46	.06 (.08)	.47	.06 (.08)	.70	.05 (.08)	.55	.03 (.09)	.77
HS employment			.03 (.02)	.08	.03 (.02)	.08	.02 (.01)	.09	.03 (.01)	.09	.02 (.02)	.11
Self-esteem					.01 (.04)	.89	-.01 (.03)	.70	-.01 (.03)	.68	-.02 (.04)	.63
Cognitive							-.05 (.04)	.16	-.05 (.04)	.17	-.08 (.04)	.04
Certificate [e]									.07 (.07)	.38	.02 (.08)	.79
Match [f]											.21 (.08)	.01
Intercept	6.54 (.11)	.00	6.44 (.14)	.00	6.10 (.14)	.00	6.19 (.13)	.00	6.51 (.15)	.00	6.38 (.17)	.00
Model fit	$F(8,401) =4.38$, $p <.001$		$F(10,395) =4.03$, $p <.001$		$F(11,397) =3.76$, $p <.001$		$F(12,396) =3.67$, $p <.001$		$F(13,395) =3.62$, $p <.001$		$F(14,349) =3.54$, $p <.001$	
	$R^2 = .06$		$R^2 = .07$		$R^2 = .07$		$R^2 = .08$		$R^2 = .08$		$R^2 = .10$	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, [e] no certificate, and [f] not matched.

Table 4.15 Results of Log Hourly Wage Rates Regressed on Transition-related Variables in 2006 (Weighted)

	Model-1 (Parental ED)		Model-2 (Employment)		Model-3 (Self-esteem)		Model-4 (Cognitive)		Model-5 (Certificate)		Model-6 (Match)	
	β *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Work exp	.10 (.03)	.01	.09 (.03)	.01	.09 (.03)	.01	.07 (.03)	.03	.07 (.04)	.06	.05 (.04)	.16
Black [a]	-.16 (.07)	.01	-.12 (.07)	.08	-.12 (.07)	.08	-.07 (.07)	.35	-.07 (.08)	.36	-.09 (.07)	.26
Hispanic [a]	.17 (.17)	*ns*	.22 (.19)	*ns*	.22 (.19)	*ns*	.25 (.19)	*ns*	.25 (.19)	*ns*	.26 (.21)	*ns*
Other-race [a]	.01 (.07)	*ns*	.04 (.07)	*ns*	-.04 (.07)	*ns*	.03 (.07)	*ns*	.02 (.07)	*ns*	.02 (.07)	*ns*
Gender [b]	.08 (.07)	*ns*	.06 (.06)	*ns*	.06 (.06)	*ns*	.07 (.06)	*ns*	.07 (.06)	*ns*	.05 (.07)	*ns*
Less than HS [c]	-.14 (.08)	.08	-.14 (.08)	.08	-.14 (.08)	.08	-.12 (.07)	.09	-.12 (.07)	.09	-.04 (.07)	.55
2Yr college [c]	-.05 (.07)	*ns*	-.03 (.07)	*ns*	-.03 (.07)	*ns*	-.05 (.09)	*ns*	-.05 (.08)	*ns*	-.01 (.08)	*ns*
4Yr college [c]	.02 (.08)	*ns*	.06 (.08)	*ns*	.06 (.09)	*ns*	.05 (.09)	*ns*	.05 (.09)	*ns*	-.06 (.08)	*ns*
Cooperative[d]			.19 (.08)	.02	.19 (.08)	.02	.19 (.08)	.02	.17 (.08)	.04	.16 (.10)	.09
HS employment			.02 (.01)	.09	.02 (.01)	.10	.01 (.01)	.15	.01 (.01)	.13	.01 (.01)	.55
Self-esteem					.00 (.05)	.96	-.03 (.05)	.57	-.03 (.05)	.51	-.03 (.05)	.51
Cognitive							-.10 (.03)	.01	-.10 (.03)	.01	-.09 (.03)	.00
Certificate [e]									.08 (.09)	.73	.03 (.09)	.73
Match [f]											.15 (.05)	.00
Intercept	6.61 (.15)	.00	6.51 (.16)	.00	6.43 (.16)	.00	6.66 (.15)	.00	6.65 (.15)	.00	6.68 (.17)	.00
Model fit	$F(8,466) = 4.69$, $p < .001$		$F(10,463) = 4.61$, $p < .001$		$F(11,462) = 4.25$, $p < .001$		$F(12,461) = 4.48$, $p < .001$		$F(13,460) = 4.26$, $p < .001$		$F(14,395) = 5.35$, $p < .001$	
	$R^2 = .04$		$R^2 = .06$		$R^2 = .06$		$R^2 = .08$		$R^2 = .08$		$R^2 = .08$	

Note. References are [a] White, [b] female, [c] high school graduate, [d] no participation in cooperative program, [e] no certificate, and [f] not matched.

Table 4.16 Minitab Output for Best Subset Predictors of Log Hourly Wage Rates, by Waves

Wave		R^2			Parental EDU								Work	
Var[a]	R^2	(adj)	Cp	S	<HS	2Yr	4Yr	Esteem[b]	Emp[c]	Coop[d]	Match[e]	Cogn[f]	exp[g]	Cert[h]
2006														
2	4.7	3.3	7.2	.6880							x		x	
3	6	4.4	3.7	.6841						x	x	x		
3	5.8	4.2	4.6	.6849							x	x	x	
4	6.3	4.4	4.5	.6839						x	x	x	x	
4	6.2	4.3	4.8	.6842					x	x	x	x		
5	6.5	4.4	5.8	.6841					x	x	x	x	x	
5	6.4	4.3	6.2	.6845		x				x	x	x	x	
6	6.6	4.2	7.4	.6847		x			x	x	x	x	x	
7	6.6	4	9.2	.6854	x	x			x	x	x	x	x	
8	6.6	3.8	11.1	.6861	x	x		x	x	x	x	x	x	
2005														
2	6.3	4.7	11.5	.6302							x	x		
3	8.1	6.3	6.5	.6250							x	x	x	
3	7.7	5.9	7.8	.6261					x		x		x	
4	8.8	6.7	5.8	.6235					x		x	x	x	
4	8.3	6.3	7.5	.6250	x						x	x	x	
5	9	6.7	6.8	.6235			x		x		x	x	x	
5	9	6.7	6.8	.6235	x				x		x	x	x	
6	9.3	6.8	7.7	.6234		x	x		x		x	x	x	
7	9.4	6.6	9.3	.6239	x	x	x		x		x	x	x	
8	9.5	6.4	11.2	.6246	x	x	x	x	x		x	x	x	
2004														
2	11.9	10.4	15.8	.4881					x			x		
3	13.9	12.2	9.4	.4831					x		x		x	
3	13.8	12.1	9.9	.4834				x	x				x	
4	14.7	12.8	8	.4815					x		x	x	x	
4	14.5	12.6	8.8	.4820				x	x		x		x	
5	15.2	13	8.1	.4809					x		x	x	x	x
5	15.1	12.9	8.5	.4812				x	x		x	x	x	
6	15.5	13.1	8.8	.4807				x	x		x	x	x	x
7	15.8	13.1	9.6	.4805	x			x	x		x	x	x	x
8	15.9	13	11.1	.4808	x		x	x	x		x	x	x	x
2003														
2	10.1	8.6	13	.5963								x	x	
3	11.9	10.2	7.6	.5910							x	x	x	
3	11.3	9.5	10.3	.5932	x						x		x	
4	12.8	10.8	6.3	.5890	x						x	x	x	
4	12.5	10.5	7.5	.5900					x		x	x	x	
5	13.3	11	6.3	.5882	x				x		x	x	x	
5	12.9	10.7	7.7	.5894	x	x					x	x	x	
6	13.4	10.9	7.7	.5885	x			x	x		x	x	x	
7	13.5	10.8	9.3	.5891	x	x		x	x		x	x	x	
8	13.6	10.6	11.1	.5897	x	x		x	x	x	x	x	x	

Note. [a]Number of variables, [b]self-esteem, [c]employment in high school, [d]cooperative program, [e]job-education match, [f]cognitive ability, [g]work experience, and [h]a training certificate.

4.4 Results of Longitudinal Analyses (Growth Modeling)

The information for job-education match and log hourly wage rates was combined from the four different cohorts determined by high school graduation class. The cohorts were defined as follows: Cohort 1, high school graduation year of 2000; Cohort 2, high school graduation year of 2001; Cohort 3, high school graduation year of 2002; and Cohort 4, high school graduation year of 2003. Section 4.1 presented results for the developmental trajectory of the job-education match; those for hourly wage rates are elaborated upon in section 4.2

4.4.1 Factors Influencing the Growth of the Job-Education Match

To explore the relationship between the transition-related variable and job-education match, the binary growth model for job-education match rates was applied. First, the visual overall trajectory for the mean job-education match rates was checked. Second, level-1 predictors and those random effects were determined. Then, Work experience x Cohort interaction was investigated to identify any cohort difference that might compound the developmental effects of the transition-related variables (Miyazaki& Raudenbush, 2000; Raudenbush & Chan, 1992). Lastly, to determine which subsets of level-2 explanatory variables were needed for inclusion in the level-2 model to specify the level-1 time variant predictors, Multiparameter[6] tests were administered. Models were built on the base model composed of level-1 and level-2 control variables, which is Model 3.

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[6] Multiparameter tests allow for investigating simultaneously whether a level-2 variable interacts with several level-1 explanatory variables (Raudenbush & Byrk, 2002, p. 60). This test is conducted without inflating level α-level, which is caused by repeating multiple univariate tests. That is, the composite hypothesis for the equation in section 4.1.4, such as H_0: $\gamma_{01} = \gamma_{11} = \gamma_{21} \ldots\ldots \gamma_{n1} = 0$, can be tested without increasing the possibility of type-1 errors (Raudenbush et al., 2004, p. 58).

4.4.1.1. Overall Trajectory of Job-Education Match Rate

Table 4.18 and Figure 4.3 show the percentage change for job-education match for four different graduation cohorts, traced for four years (2003–2006). As shown in Table 4.18, the percentage for the job-education match was around 48% right after high school graduation and 85% six years after entering the labor market. Each cohort shows the common trends within cohorts that as years after high school graduation accumulate, the percentage of the job-education match also increases but its increments between years of work experience decreases gradually, which is indicative of a parabolic type of job-education match trajectory.

The percentages for the job-education match between cohorts with the same years of work experience after high school graduation are close to those for adjacent cohorts except Year 3. A chi-square test shows no significant difference in percentage of job-education match across years after high school graduation except Year 3. As shown in Table 4.17, the chi-square test for Year 3 revealed that workers in cohort 2 (graduation class of 2002) showed a significantly higher job-education match than other cohorts, $\chi^2(3, N = 418) = 11.55, p < .01, V^* = .17$. Figure 4.3 reflects this trend.

Table 4.17 Result of Chi-Square Test for Job-Education Match in Year 3

Percentage of Job-Education Match for Year 3			
Cohort 1	Cohort 2	Cohort 3	Cohort 4
$70\%_a$	$66\%_a$	$78\%_b$	$58\%_a$

Note. Percentages with different subscript differ at $p < .05$ using Holm's sequential bonferroni post hoc comparisons (Holm, 1979).

The job-education match trajectories for each cohort shown in Figure 4.3 are similar to those of other cohorts with the exception of year 3. Trajectories for each cohort shifted diagonally toward the job-education match, suggesting the effects of work experience or aging on job-education match.

Table 4.18 Percentage of Job-Education Match (Weighted), by Years after High School Graduation, Cohort, and Cross-Sectional Waves

		Years after high school graduation						
Cohort	*n*[a]	0	1	2	3	4	5	6
Mean matching rate		48%	59%	66%	68%	77%	77%	85%
Cohort								
Cohort 1: Class 2003	50	48%	60%	65%	58%			
Cohort 2: Class 2002	146		59%	67%	78%	76%		
Cohort 3: Class 2001	156			67%	66%	75%	72%	
Cohort 4: Class 2000	67				70%	80%	83%	85%
Cross-sectional wave					2003	2004	2005	2006

Note. [a]Average unweighted observations across years after high school graduation. Cross-sectional waves are indicated by cell shading in the table.

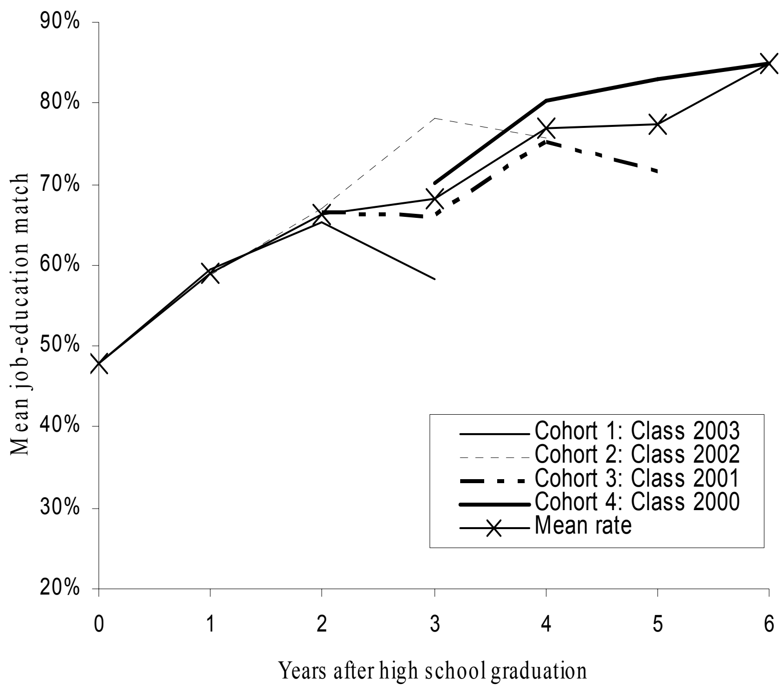

Figure 4.3 Trajectory of mean job-education match

4.4.1.2. Level-1 Model Construction and Determination of Variance Components

A Level-1 model was specified with time variant predictors such as linear and quadratic forms of work experience, resulting in the arch-shaped growth curve depicted in Figure 4.3. Then, possession of a training certificate was added to the job-education growth trajectory. After estimating whether job-education match varies across individuals in a null model, time variant level-1 predictors were added to the null model. The previous research suggested that group mean centering led to a more accurate estimate when the mean value of level-1 variables varies across level-2 units. Furthermore, group mean centering is advised for accelerated longitudinal designs (Miyazaki& Raudenbush, 2000; Raudenbush & Byrk, 2002). Work experience and squared work experience, with the exception of a training certificate, were centered around the group (individual) mean, i.e., *group mean centering*. Mean values of three level-1 predictors were incorporated into the overall intercept of the level-2 model (β_{0i}) (Koenig & Lissitz, 2001). Level-1 models a job-education match trajectory associated with years of work experience after high school graduation as the baseline with the component of the effects of a training certificate added to the trajectory.

Then, a random intercept and a random coefficient model were tested using a Chi-square test. Results showed that the variance component for the random intercept was significant but that those for the slope coefficients were not. Therefore, the other coefficients with the exception of the overall intercept (β_{0i}) were fixed ($u_{pi} = 0$, $1 \leq p \leq 3$) in the level-2 equation so that the effects of level-2 variables were constrained to be the same for all individuals. The model-based and robust standard errors converged for all coefficients, implying that the random intercept model fits the data. Specifically, the model was depicted as follows:

$$\eta_{ti} = log\ [\pi_{ti}/(1- \pi_{ti})] = \beta_{0i} + \sum_{p=1}^{p} \beta_{pi} X_{pi}$$

$$\beta_{0i} = \gamma_{00} + \sum_{q=1}^{3} \gamma_{oq}\ \overline{X}_{qi} + u_{0j}$$

$$\beta_{pi} = \gamma_{p0} \qquad\qquad for\ 1 \leq p \leq 3$$

Where η_{ti} is the log-odds that job-education has matched; π_{ti} is the probability that the education level of an observation *I* in individual *j* is matched with education level required in O'Net, with $\pi_{ti} = 1$ representing job-education match; *X* is work experience, squared work experience, and certificate; and $\overline{X}$ is individual's mean values for *X*.

4.4.1.3. Test for Cohort Effects

Before combining four different trajectories into one common trajectory, tests were conducted to determine whether the convergence of the job-education match might be compounded by cohort difference and interaction effects of cohorts and level-1 predictors. The interaction effects of level-1 variables with cohorts were examined by applying multiparameter tests. Three dummy variables (D_{qj}, $q = 1, 2, and\ 3$) representing cohort membership with Cohort 4 as the reference group were incorporated into the level-2 model. Cohort dummy was not included in intercept (β_{0i}) due to collinearity with the work experience variable. However, no significant cohort effects were found ($p > .50$).

$$\eta_{ti} = log\ [\pi_{ti}/(1-\pi_{ti})] = \beta_{0i} + \sum_{p=1}^{p} \beta_{pi} X_{pi}$$

$$\beta_{0i} = \gamma_{00} + \sum_{q=1}^{3} \gamma_{oq} \overline{X}_{qi} + u_{0j}$$

$$\beta_{pi} = \gamma_{p0} + \sum_{s=1}^{3} \gamma_{ps} D_{si} \qquad for\ 1 \leq p\ \&\ s \leq 3$$

4.4.1.4. Multiparamenter Test and Potential Final Model

To examine which subsets of level-2 variables were needed in a level-2 intercept and which variables at level-2 interact with the level-1 variable, multiparameter tests for the relationship between predictors and job-education match were applied with control variables included. Test results, which were only adjusted by control variables, showed that parental education, high school study of course, cooperative program, mentor, high school employment, and noncognitive behavior needed to be incorporated into the overall intercept of the level-2 model (β_{0i}). In addition, a coefficient for linear work experience (β_{1i}) needed to be specified with Tech-prep program. Training certificate (β_{3i}) was affected by mentor. For two variables showing cross-level interaction effects, their direct effects were incorporated into the overall intercept (β_{0i}), even though they were not significant (Hox, 2002, p. 58). The tentative final model was specified as follows:

$$\eta_{ti} = log\ [\pi_{ti}/(1-\pi_{ti})] = \beta_{0i} + \beta_{1i}(Exp) + \beta_{2i}(Exp\text{-}Squared) + \beta_{3i}(Training\ Certificate)$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01}\,(Mean\ Exp) + \gamma_{02}\,(Mean\ Exp\text{-}Squared) + \gamma_{03}\,(Mean\ Training\ Cert)$$

$$\gamma_{04\sim06}\,(Race) + \gamma_{07}\,(Gender) + \gamma_{08\sim010}\,(Parental\ Education) +$$

$$\gamma_{011\sim014}\,(HS\ Study\ of\ Course) + \gamma_{015}\,(Cooperative) + \gamma_{016}\,(Tech\text{-}Prep) +$$

$$\gamma_{017}\,(Mentor) + \gamma_{018}\,(HS\ Employment) + \gamma_{019}\,(Non\text{-}cognitive) + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}\,(Tech\text{-}Prep)$$

$$\beta_{2i} = \gamma_{20}$$

$$\beta_{3i} = \gamma_{30} + \gamma_{31}\,(Mentor)$$

4.4.1.5 Null Model and Models with Level-1 and Level-2 Control Variables

Model 1 in Table 4.19 presents the results of null model. The null model shows that the average log-odds of job-education match across individuals (γ_{00}), is 0.98. Converted to a probability by using the transformation (1/1+exp {- η_{ti}}) (Raudenbush &

Table 4.19 Null Model and Models Specified with Level-1 and Level-2 Control Variables

	Model 1 (Null model)			Model 2 (Level-1 variables)			Model 3 (Race & gender)		
Fixed Effect	β *(SE)*	*p*	e^{β} (95% CI)	β *(SE)*	*p*	e^{β} (95% CI)	β *(SE)*	*p*	e^{β} (95% CI)
Individual mean status, β_{0i}									
Intercept, γ_{00}	.98 (.10)	.00	2.66 (2.19;3.23)	.97 (.16)	.00	2.64 (1.90; 3.66)	.87 (.22)	.00	2.98 (2.03; 4.37)
Mean Exp, γ_{01}				.51 (.68)	.46	*ns*	.38 (.68)	.58	*ns*
Mean squared exp, γ_{02}				-.03 (.11)	.79	*ns*	-.01 (.11)	.93	*ns*
Mean certificate, γ_{03}				.14 (.48)	.78	*ns*	.18 (.49)	.71	*ns*
Black, γ_{04}							-.37 (.22)	.10	.69 (.44; 1.08)
Hispanic, γ_{05}							-.12 (.34)	.71	*ns*
Other_race, γ_{06}							-.41 (.31)	.19	*ns*
Gender, γ_{07}							.38 (.20)	.06	1.47 (.99; 2.19)
Mean growth rate, β_{1i}									
Intercept, γ_{10}				.16 (.06)	.01	1.18 (1.05; 1.32)	.17 (.06)	.01	1.18 (1.05;1.33)
Mean acceleration rate, β_{2i}									
Intercept, γ_{20}				-.10 (.06)	.06	.90 (.81; 1.01)	-.10 (.06)	.07	.90 (.81; 1.01)
Mean slope for certificate, β_{3i}									
Intercept, γ_{30}				.72 (.41)	.06	2.13 (.96; 4.75)	.77 (.41)	.06	2.16 (.97; 4.82)
Random effect, μ_{0i}	Var		*p*	Var		*p*	Var		*p*
	2.17		$\chi^2(520) = 1106$ $p < .001$	2.17		$\chi^2(517) = 1108$ $p < .001$	2.14		$\chi^2(513) = 1092$ $p < .001$

Bryk, 2002), the average log-odds correspond to 73% of the job-education match probability, implying that the typical match rate is 73 % for individuals with up to six years of work experience. Level-two variance (u_{0i}) was significant, suggesting that match rates vary across individuals. Ninety-five percent of individuals had a confidence interval of job-education log-odds between .98 ± 1.96* SQRT (2.17) = (-1.91, .98). As the log odds were converted into probabilities, 95% of individuals had a confidence interval of job-education match probability ranging from 13–98%.

In model 2, level-1 explanatory variables such as work experience and training certificate and their mean values were added to the null model. The linear term (γ_{10}) for work experience was significant; as workers accumulate work experience, the log-odds of job-education match increase. The quadratic terms (γ_{20}) for work experience were close to significant (p = .06). The negative rate for quadratic terms (γ_{20}) indicated that it decreases as work experience increases. Training certificate was close to significant (p = .06) and had a positive relationship with job-education match (γ_{20} = .72). Figures 4.4 and 4.5 plotted the overall pattern for fitted values on log-odds and probabilities of job-education match across work experience. Level-1 specification with linear and quadratic terms for work experience led to the formulation of base rates for job-education match growth and training certificate and was then specified with the addition of base rates for work experience. As work experience accumulates, the probabilities of a job-education match increase and then slightly decrease after some point of time. Obtaining a training certificate shifted base lines upward in Figures 4.4 and 4.5.

In model 3, other control variables such as worker's race and gender were added to level-2. Being Black was associated with higher log-odds of job-education mismatch than was the case for White workers at a significance level of .05(γ_{01} = -.37). The log-odds for Black workers were .69 times the odds for White workers. The Black workers had a 65% probability of match, which is associated with a 5% decrease in match probability compared to White workers. The probability of a job-education match for male workers was 7% higher than that for female workers (p = .06).

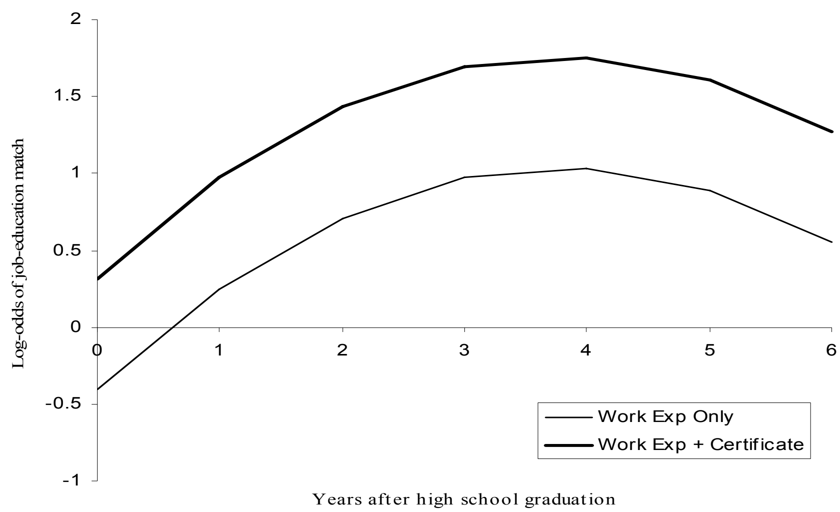

Figure 4.4 Log-odds of job-education match across time

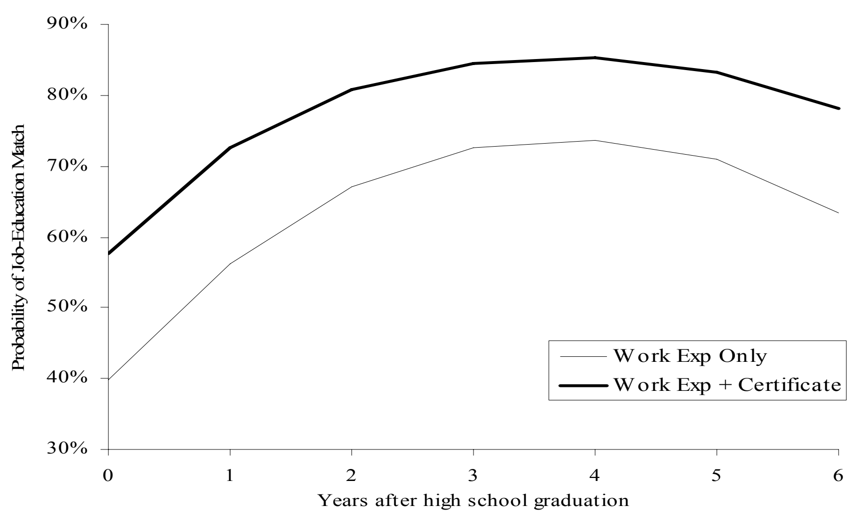

Figure 4.5 Probabilities of job-education match across time

4.4.1.6 Effects of Family Background on Job-Education Match

Table 4.20 presents the results for family background on job-education match. In Model 4, family background variables such as parent education level and extent of parental support in high school senior year were added to Model 3. Multiparameter tests

Table 4.20 Effects of Parental Education on Job-Education Match

	Model 3 (Race & Gender)			Model 4 (Parental Education)		
Fixed Effect	β *(SE)*	*p*	e^{β} (95% CI)	β *(SE)*	*p*	e^{β} (95% CI)
Individual mean status, β_{0i}						
Intercept, γ_{00}	.87 (.22)	.00	2.98 (2.03; 4.37)	1.02 (.25)	.00	2.76 (1.70; 4.49)
Black, γ_{04}	-.37 (.22)	.10	.69 (.44; 1.08)	-.35 (.23)	.13	.70 (.45; 1.07)
Hispanic, γ_{05}	-.12 (.34)	.71	*ns*	-.02 (.31)	.95	. *ns*
Other_race, γ_{06}	-.41 (.31)	.19	*ns*	-.24 (.30)	.44	. *ns*
Gender, γ_{07}	.38 (.20)	.06	1.47 (.99; 2.19)	.35 (.21)	.09	1.42 (.95; 2.13)
Less than HS, γ_{08}				-.41 (.24)	.08	.66 (.41; 1.06)
Associate, γ_{09}				-.52 (.26)	.04	.59 (.36; .99)
Bachelor, γ_{010}				.12 (.40)	.76	*ns*
Mean growth rate, β_{1i}						
Intercept, γ_{10}	0.17 (.06)	.01	1.18 (1.05;1.33)	.17 (.06)	.01	1.18 (1.05; 1.33)
Mean acceleration rate, β_{2i}						
Intercept, γ_{20}	-.10 (.06)	.07	.90 (.81; 1.01)	-.11 (.06)	.06	.90 (.81; 1.01)
Mean slope for certificate, β_{3i}						
Intercept, γ_{30}	.77 (.41)	.06	2.16 (.97; 4.82)	.78 (.41)	.06	2.10 (.96; 4.90)
Random effect, μ_{0i}	Var		*p*	Var		*p*
	2.14		$\chi^2(513) = 1092$ $p < .001$	2.12		$\chi^2(513) = 1087$ $p < .001$

Note. Mean Exp (γ_{01}), Mean squared exp (γ_{02}), and Mean certificate (γ_{03}) are not presented.

showed that only parent education levels needed to be incorporated into the intercept in the level-2 model. Parent education less than high school was close to significant (p = .08) and was negatively related to job-education match compared to workers whose parents were high school graduates (γ_{05} = -.41). The odds of a job-education match for young workers whose parents had less than a high school education were .63 times the odds of a job-education match for other workers whose parents had a high school education. The probability of a job-education match was 8% less than that of counterparts with high school graduate parents, *ceteris paribus*. Parent education equal to an associate degree was also associated with a lower job-education match (p = .04 & γ_{06} = -.52). However, parental support failed to reject the null hypothesis that intercept (β_{0i}) and slope (β_{1i}, β_{2i}, β_{3i}) in the level-1 model were not related to parental support.

4.4.1.7 Effects of High School Experience on Job-Education Match

Table 4.21 presents the effects of course of study in high school, participation in school-to-work program, and employment in high school on job-education match. The coefficient formulation was determined with multiparameter tests. In Model 5, high school course of study were added to the Model 3. The comprehensive course was associated with higher job-education match (γ_{013}= 1.10, p = .02). The odds of job-education match for the comprehensive course were 3.00 times the odds for the general course, after holding constant other variables. Workers who took the comprehensive course experienced an 18% increase in job-education match probability compared to workers who took the general course in high school. College-prep course and vocational

Table 4.21 Effects of Course of Study, School-to-Work Program, and Employment in High School

	Model 5 (Course of study)			Model 6 (School-to-work)			Model 7 (Employment)		
Fixed Effect	*β* *(SE)*	*p*	e^{β} (95% CI)	*β* *(SE)*	*p*	e^{β} (95% CI)	*β* *(SE)*	*p*	e^{β} (95% CI)
Individual mean status, β_{0i}									
Intercept, γ_{00}	.81 (.22)	.00	2.24. (1.44; 3.48)	.67 (.23)	.00	1.96 (1.24; 3.09)	.83 (.22)	.00	2.30 (1.49; 3.60)
Black, γ_{04}	-.37 (.23)	.10	.69 (.44; 1.08)	-.35 (.22)	.12	.70 (.44; 1.11)	-.25 (.23)	.27	.78 (.49; 1.23)
Hispanic, γ_{05}	-.11 (.35)	.74	*ns*	-.01 (.34)	.98	*ns*	-.04 (.34)	.90	*ns*
Other_race, γ_{06}	-.34 (.31)	.27	*ns*	-.36 (.29)	.22	*ns*	-.30 (.30)	.33	*ns*
Gender, γ_{07}	.33 (.20)	.10	1.39 (.93; 2.08)	.31 (.20)	.12	1.36 (.92; 2.02)	.33 (.20)	.10	1.40 (.94; 2.09)
Coll_prep, γ_{011}	.11 (.29)	.68	*ns*						
Voca, γ_{012}	.11 (.32)	.73	*ns*						
Compre, γ_{013}	1.10 (.48)	.02	3.00 (1.18; 7.63)						
Other_cou, γ_{014}	-.93 (1.17)	.43	*ns*						
Cooperative, γ_{015}				.86 (.27)	.00	2.36 (1.39; 4.04)			
Tech-prep, γ_{016}				.04 (.25	.89	*ns*			
Mentor, γ_{017}				.54 (.41)	.19	*ns*			
HS Employment, γ_{018}							.08 (.04)	.04	1.09 (1.01; 1.18)
Mean growth rate, β_{1i}									
Intercept, γ_{10}	.17 (.06)	.01	1.18 (1.05; 1.33)	.12 (.07)	.07	1.13 (.99; 1.28)	.17 (.06)	.01	1.18 (1.05; 1.33)
Tech_prep, γ_{11}				.27 (.15)	.08	1.31 (.97; 1.77)			
Mean acceleration rate, β_{2i}									
Intercept, γ_{20}	-.10 (.06)	.07	.90 (.81; 1.01)	-.10 (.06)	.08	.90 (.81; 1.01)	-.10 (.06)	.07	.90 (.81; 1.01)
Mean slope for certificate, β_{3i}									
Intercept, γ_{30}	.74 (.40)	.07	2.05 (.95; 4.62)	.98 (.41)	.02	2.68 (1.21; 5.94)	.76 (.41)	.06	2.15 (.96; 4.82)
Mentor, γ_{31}				-1.45 (.62)	.02	.22 (.07; .77)			
Random effect, μ_{0i}	Var		*p*	Var			Var		*p*
	2.10		$\chi^2(509) = 1087$ $p < .001$	2.08		$\chi^2(510) = 1074$ $p < .001$	2.12		$\chi^2(512) = 1081$ $p < .001$

Note. Mean Exp (γ_{01}), Mean squared exp (γ_{02}), and Mean certificate (γ_{03}) are not presented

course were associated with higher match probabilities than general course, but coefficients for those were not significant—p = .68 and p = .73, respectively.

Model 6 presents the relationship between participation in school-to-work program and job-education match. Multiparameter tests showed that cooperative program, tech-prep program, and mentor program were related to job-education match. Cooperative program had an effect on the intercept of the job-education match growth model (γ_{015}= .86 & $p < .001$). Participation in cooperative program during high school enhanced the possibility of job-education match across the time-span considered in this research. Workers who took part in a cooperative program experienced a 16% increase in job-education match probability compared to workers who did not participate in the program. Participation in this program shifted baselines upward in Figures 4.4 and 4.5.

Meanwhile, unlike the effect of cooperative program on the intercept, participation

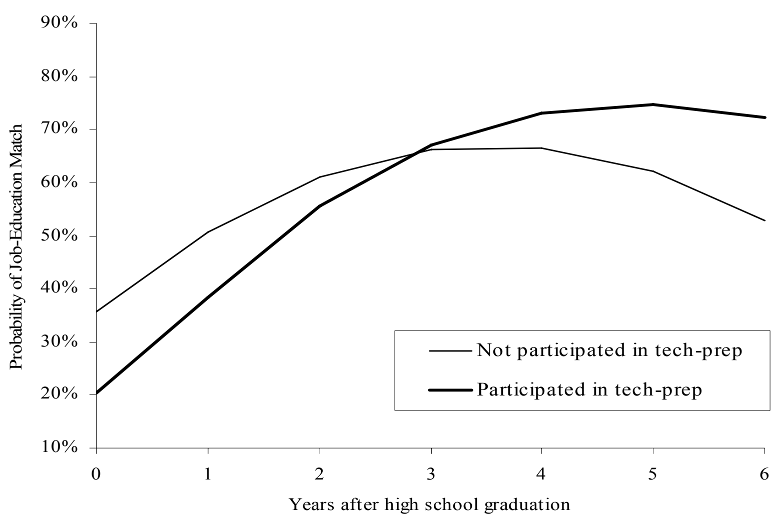

Figure 4.6 Effects of tech-prep on job-education match

in a tech-prep program changed the linear growth rate for job-education match: interaction effect of participation in tech-prep with work experience (γ_{11} = .28 & p = .06). Figure 4.6 plots the fitted value after controlling for race and gender. As shown in Figure 4.6, participation in tech-prep lowered the probabilities of job-education match at the onset of labor market entry, but enhanced those probabilities at later stages of work.

The mentor program exhibited interaction effects with training certificate obtained after high school graduation (γ_{31} = −1.45 & p = .02)[7]. Curve B, the curve for those who did not participate in a mentor program in high school but obtained a certificate after high school, had the highest probabilities for job-education match. Curve A, the curve for those who did not participate in a mentor program and obtain a certificate after high school showed the lowest probabilities for job-education match. The effect of participation in a mentor program depended on whether it was followed by

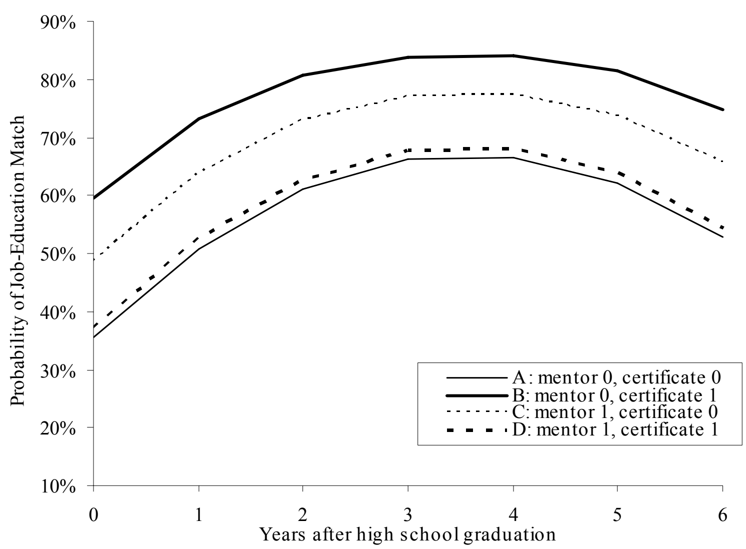

Figure 4.7 Effects of mentoring programs on job-education match

obtaining a training certificate. The increase in job-education match probability by

[7] The same pattern of effects was displayed in the job shadow program and enterprise program. Only the effect of mentoring program was significant when all school-to-work programs were saturated. .

participation in a mentor program had a larger effect when workers did not obtain a training certificate after high school graduation. The interaction effect of mentor × training certificate was still effective, even after cognitive and noncognitive skills were controlled.

Employment during high school showed a positive effect on job-education match (γ_{018}= .08 & p = .04). High school job elevated the intercept in the job-education match growth model. That is, a unit increase (1000 hours) in total hours worked during high school above the overall mean level (M = 3.20, SD =.39) enhanced the job-education match probability by 2% across the life-span.

Models 8 and 9 in Table 4.22 revealed the ways in which variables relating to high school experience were affected by other variables when high school experience was considered. Compared to the coefficient for comprehensive course of study in Model 5, Table 4.21, course of study was not affected by employment in high school. However, the size and statistical significance of the coefficient for employment in high school were a little lower. When school-to-work programs were included, there was a reduction in size and statistical significance for the coefficient for the comprehensive course (γ_{013}). School-to-work programs were little affected by course of study and employment in high school; the size and statistical significance for the coefficient for the mentor program decreased a little. This implies that the effects for school-to-work programs are independent of other variables.

Table 4.22 Effects of High School Experience on Job-Education Match

	Model 8 (Course + HS emp.)			Model 9 (HS experience)		
Fixed Effect	*β* *(SE)*	*p*	e^{β} (95% CI)	*β* *(SE)*	*p*	e^{β} (95% CI)
Individual mean status, β_{0i}						
Intercept, γ_{00}	.78 (.22)	.00	2.19 (1.41; 3.04)	.65 (.24)	.01	1.91 (1.21; 3.05)
Black, γ_{04}	-.26 (.23)	.26	.77 (.48; 1.22)	-.25 (.24)	.29	.78 (.48; 1.25)
Hispanic, γ_{05}	-.03 (.33)	.93	*ns*	.04 (.34)	.90	*ns*
Other_race, γ_{06}	-.25 (.31)	.41	*ns*	-.23 (.29)	.43	*ns*
Gender, γ_{07}	.29 (.20)	.15	1.34 (.90; 2.00)	.25 (.20)	.21	1.29 (.87; 1.91)
Coll_prep, γ_{011}	.09 (.29)	.77	*ns*	.01 (.29)	.76	*ns*
Voca, γ_{012}	.07 (.32)	.83	*ns*	-.08 (.32)	.81	*ns*
Compre, γ_{013}	1.06 (.48)	.03	2.89 (1.13; 7.38)	.76 (.47)	.10	2.14 (.85; 5.42)
Other_cou, γ_{014}	-.81 (1.18)	.49	*ns*	-.81 (1.17)	.49	*ns*
Cooperative, γ_{015}				.78 (.27)	.01	2.19 (1.27; 3.76)
Tech-prep, γ_{016}				-.02 (.25)	.91	*ns*
Mentor, γ_{017}				.36 (.41)	.37	*ns*
HS Employment, γ_{018}	.07 (.04)	.07	1.08 (.99; 1.16)	.06 (.04)	.13	1.06 (.98; 1.15)
Mean growth rate, β_{1i}						
Intercept, γ_{10}	.17 (.06)	.01	1.18 (1.05;1.33)	.12 (.07)	.07	1.13 (.99; 1.28)
Tech_prep, γ_{11}				.27 (.15)	.08	1.31 (.97; 1.78)
Mean acceleration rate, β_{2i}						
Intercept, γ_{20}	-.10 (.06)	.07	.90 (.81; 1.01)	-.10 (.06)	.08	.91 (.81; 1.01)
Mean slope for certificate, β_{3i}						
Intercept, γ_{30}	.77 (.41)	.06	2.10 (.95; 4.64)	.93 (.41)	.02	2.53 (1.15; 5.60)
Mentor, γ_{31}				-1.15 (.62)	.06	.31 (.09; 1.05)
Random effect, μ_{0i}	Var	*p*		Var	*p*	
	2.09	$\chi^2(508) = 1077$ $p < .001$		2.06	$\chi^2(505) = 1065$ $p < .001$	

Note. Mean Exp (γ_{01}), Mean squared exp (γ_{02}), and Mean certificate (γ_{03}) are not presented

4.4.1.8 Effects of Noncognitive and Cognitive Ability on Job-Education Match

Multiparameter tests showed that only self-esteem among noncognitive abilities was related to job-education match and was significant in the intercept position (γ_{017}= .48 & p = .00). Model 9 in Table 4.22 indicated that self-esteem shifted upward the job-education match growth curve. A unit increase in self-esteem (M = 2.59, SD =.71) above the mean enhanced job-education match probability by ten percent; one

Table 4.23 Effects of Noncognitive and Cognitive Ability on Job-Education Match

	Model 10 (Self-esteem)			Model 11 (Cog. & Noncog.)		
Fixed Effect	β *(SE)*	p	Odds ratio (95% CI)	β *(SE)*	p	Odds ratio (95% CI)
Individual mean status, β_{0i}						
Intercept, γ_{00}	.82 (.22)	.00	2.27 (1.48; 3.50)	.82 (.22)	.00	2.26 (1.47; 3.48)
Black, γ_{04}	-.26 (.23)	.25	.77 (.49; 1.20)	-.22 (.24)	.37	.80 (.50; 1.29)
Hispanic, γ_{05}	-.05 (.34)	.88	*ns*	-.03 (.35)	.93	*ns*
Other_race, γ_{06}	-.34 (.30)	.27	*ns*	-.34 (.30)	.26	*ns*
Gender, γ_{07}	.40 (.20)	.04	1.48 (1.00; 2.21)	.40 (.20)	.05	1.48 (1.00; 2.21)
Self-esteem, γ_{019}	.48 (.15)	.00	1.62 (1.21; 2.16)	.46 (.15)	.00	1.59 (1.18; 2.14)
Cognitive, γ_{020}				-.07 (.11)	.52	.93 (.75; 1.16)
Mean growth rate, β_{1i}						
Intercept, γ_{10}	.17 (.06)	.01	1.18 (1.05; 1.33)	.17 (.06)	.01	1.18 (1.05; 1.33)
Mean acceleration rate, β_{2i}						
Intercept, γ_{20}	-.11 (.06)	.06	.90 (.80; 1.00)	-.11 (.06)	.05	.90 (.80; 1.00)
Mean slope for certificate, β_{3i}						
Intercept, γ_{30}	.77 (.41)	.06	2.17 (.97; 4.85)	.78 (.41)	.06	2.14 (.97; 4.90)
Random effect, μ_{0i}	Var		p	Var		p
	2.08		$\chi2(512) = 1076$ $p < .001$	2.07		$\chi2(511) = 1075$ $p < .001$

Note. Mean Exp (γ_{01}), Mean squared exp (γ_{02}), and Mean certificate (γ_{03}) are not presented

standard deviation increase in self-esteem above the mean (.71 * .48) increases the job-education match probability by 7%, compared to 83% at the mean level of worker's self-esteem. Of interest was that gender became significant ($\gamma_{07} = .40$ & $p = .04$) when self-esteem was controlled; male workers exhibited an 8% higher probability for job-education match than did female workers.

The multiparameter test for cognitive ability showed that cognitive ability did not need to be specified in the model. Model 11 in Table 4.23 showed that self-esteem in job-education match had independent effects on cognitive ability, whereas the coefficient for cognitive ability was negative and not significant ($\gamma_{018} = -.07$ & $p = .52$).

4.4.1.9. Final Model

In model 11, when controlling for parent education level, comprehensive course of study was significant and positively related to job-education match, implying that effect of comprehensive course is independent of parental background. However, when other high school experiences such as school-to-work programs and employment in high school were considered, the course effect was reduced and became insignificant. When self-esteem was included, its reduction in size and statistical significance became larger.

As shown in models 13 and 14, the effects of school-to-work programs such as cooperative, tech-prep, and mentor were stable and significant or close to significant, regardless of the inclusion of other variables in the model. The effect of parent education less than high school on the job-education match was close to significant. Its effect was consistent and not affected by other variables.

Table 4.24 Effects of Course of Study, School-to-Work Program, and Employment in High School

	Model 12 (Course of study)			Model 13 (HS experience)			Model 14 (Self-esteem)		
Fixed Effect	β *(SE)*	*p*	e^{β} (95% CI)	β *(SE)*	*p*	e^{β} (95% CI)	β *(SE)*	*p*	e^{β} (95% CI)
Individual mean status, β_{0i}									
Intercept, γ_{00}	.94 (.25)	.00	2.57. (1.57; 4.19)	.76 (.26)	.00	2.14 (1.29; 3.56)	.76 (.26)	.00	2.14 (1.29; 3.54)
Less than HS, γ_{08}	-.41 (.24)	.09	.66 (.41; 1.06)	-.42 (.24)	.08	.65 (.41; 1.05)	-.46 (.24)	.06	.63 (.40; 1.02)
Associate, γ_{09}	-.47 (.26)	.07	.62 (.37; 1.05)	-.36 (.26)	.17	.70 (.42; 1.16)	-.34 (.26)	.19	.71 (.43; 1.18)
Bachelor, γ_{010}	.14 (.42)	.76	*ns*	.25 (.44)	.57	*ns*	.17 (.44)	.70	*ns*
Coll_prep, γ_{011}	.12 (.30)	.73	*ns*	.08 (.30)	.79	*ns*	-.07 (.30)	.82	*ns*
Voca, γ_{012}	.14 (.32)	.67	*ns*	-.05 (.33)	.87	*ns*	-.06 (.32)	.85	*ns*
Compre, γ_{013}	1.05 (.48)	.03	2.85 (1.12; 7.29)	.72 (.48)	.13	2.06 (.81; 5.25)	.54 (.48)	.26	1.71 (.67; 4.36)
Other_cou, γ_{014}	-1.02 (1.15)	.38	*ns*	-.91 (1.13)	.42	*ns*	-1.06 (1.16)	.36	*ns*
Cooperative, γ_{015}				.80 (.27)	.00	2.23 (1.31; 3.80)	.77 (.27)	.00	2.17 (1.28; 3.68)
Tech-prep, γ_{016}				-.00 (.26)	.99	*ns*	.04 (.26)	.87	*ns*
Mentor, γ_{017}				.34 (.41)	.41	*ns*	.33 (.41)	.43	*ns*
HS Employment, γ_{018}				.06 (.04)	.18	1.06 (.98; 1.15)	.06 (.04)	.15	1.06 (.98; 1.15)
Self-esteem, γ_{019}							.46 (.15)	.00	1.59 (1.19; 2.11)
Mean growth rate, β_{1i}									
Intercept, γ_{10}	.17 (.06)	.01	1.18 (1.05;1.33)	.12 (.07)	.07	1.13 (.99; 1.28)	.12 (.07)	.07	1.13 (.99; 1.29)
Tech_prep, γ_{11}				.27 (.15)	.08	1.31 (.97; 1.77)	.27 (.15)	.08	1.32 (.97; 1.79)
Mean acceleration rate, β_{2i}									
Intercept, γ_{20}	-.11 (.06)	.07	.90 (.81; 1.01)	-.10 (.06)	.08	.90 (.81; 1.01)	-.10 (.06)	.07	.90 (.80; 1.01)
Mean slope for certificate, β_{3i}									
Intercept, γ_{30}	.75 (.40)	.06	2.12 (.95; 4.70)	.94 (.41)	.02	2.56 (1.15; 5.71)	.96 (.41)	.02	2.60 (1.16; 5.85)
Mentor, γ_{31}				-1.17 (.61)	.06	.31 (.09; 1.04)	-1.26 (.61)	.04	.28 (.09; .93)
Random effect, μ_{0i}	Var		*p*	Var			Var		*p*
	2.08		$\chi^2(506) = 1081$ $p < .001$	2.04		$\chi^2(502) = 1059$ $p < .001$	2.00		$\chi^2(501) = 1045$ $p < .001$

Note. Mean exp (γ_{01}), mean squared exp (γ_{02}), mean certificate (γ_{03}), race ($\gamma_{04} – \gamma_{06}$), and gender ($\gamma_{07}$) are not presented

4.4.2. Relationship among School-to-Work Transition Variables, Job-Education Match and Hourly Wage Rates

To investigate the effects of the transition-related variable and job-education match on hourly wage rates, a growth model for wage rates was applied. Analysis focused on the mediation effect of job-education match on the relationship between the transition-related variable and hourly wage rates, using Judd and Kenny's method (1981). First, the reduced model without job-education match in the level-1 equation was specified. Then, any Cohort-Work experience interaction effect was examined. Using a Multiparamenter test, each model was built on the base model composed of level-1 and level-2 control variables. Lastly, the full model with the job-education match in the level-1 equation was investigated, and then contrasted with the coefficients of the reduced model.

4.4.2.1. Overall Trajectory of the Job-Education Match Rate

Table 4.25 and Figure 4.8 present the mean log hourly wage rates for four different graduation cohorts. As shown in Table 4.25, the average log hourly wage rate was 6.47 ($6.44 in 2006 $) right after high school graduation and 7.18 ($13.18 in 2006 $) six years after entering the labor market. Each cohort revealed common trends within cohorts—e.g., as years after high school graduation accumulated, average log hourly wage rates also increased without exception. Increments between years held relatively constant, which implied a linear type of log hourly wage growth trajectory as shown in Figure 4.8, suggesting the effects of work experience or aging.

The log hourly wage rates between cohorts with the same years of work experience after high school graduation were close to those for adjacent cohorts, but

Table 4.25 Mean Log Hourly Wage Rates, by Years after High School Graduation, Cohort, and Cross-Sectional Waves

		Years after high school graduation						
Cohort	*n*	0	1	2	3	4	5	6
Mean log wage rates		6.47	6.63	6.77	6.90	6.96	7.10	7.18
Cohort								
Cohort 1: Class 2003	48	6.47	6.64	6.79	6.91			
Cohort 2: Class 2002	150		6.62	6.78	6.94	6.97		
Cohort 3: Class 2001	160			6.74	6.86	7.00	7.10	
Cohort 4: Class 2000	68				6.89	6.91	7.10	7.18
Cross sectional wave					2003	2003	2003	2003

Note. [a]Average unweighted observations across years after high school graduation. Hourly wage rates reflect 2006 dollar value.

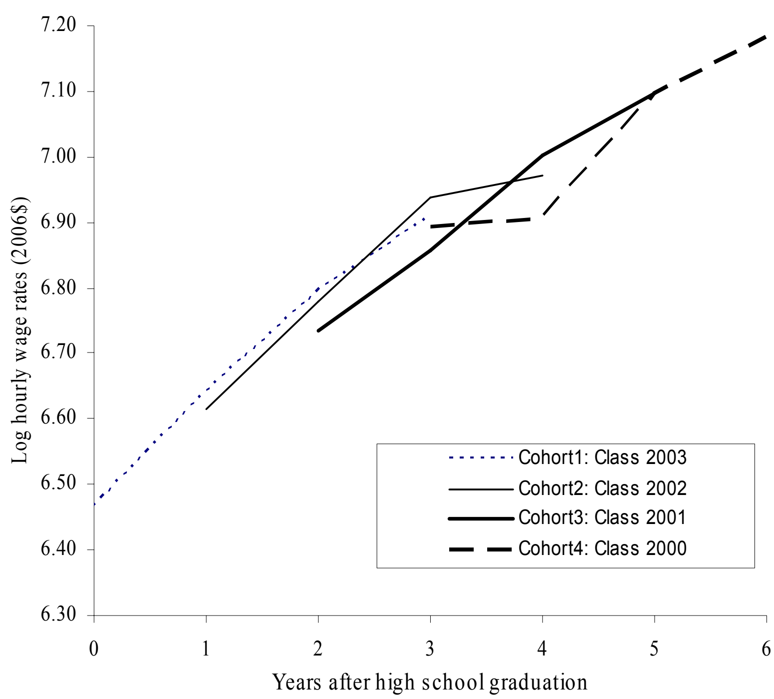

Figure 4.8 Trajectory of mean log hourly wage rates

Note. Wage rates: Measured in Cents

younger cohorts showed a minimal increase in log hourly wage rates than older cohorts. Even so, one-way ANOVA tests supported the finding of no cohort difference in log hourly wage rates for workers with the same years of work experience after high school graduation by revealing no differences in log hourly wage rates among cohorts: Year 2, $F(2, 553) = .83, p = .44$; Year 3, $F(3, 349) = .38, p = .77$; and Year 4, $F(2, 564) = .17, p = .85$. These results suggest that one trajectory line can be fit to the data.

4.4.2.2. Level-1 Model Construction and Determination of Variance Components

Time variant predictors were added to the level-1 model. As Mincer (1974) suggested, linear work experience and squared work experience were incorporated into the level-1 equation. Then, a training certificate and job-education match were tested for inclusion in the level-1 model. Level-1 variables, except for training certificate and job-education match which were uncentered, were centered on the group (individual) mean.

Test results revealed that a training certificate became insignificant when job-education match was included in the level-1 model. Furthermore, deviance scores, calculated from each combination of four variables by using full maximum likelihood, were compared to determine whether a training certificate needs to be incorporated into the level-1 equation. The difference between models with and without a training certificate in deviances statistics was 0 (2541.31-2541.31), which showed that a training certificate could be omitted from a model. Therefore, the final level-1 model was specified with linear work experience, squared work experience, and job-education match and the mean values for those three variables ($\overline{X}_{qi}$, $1 \leq q \leq 3$) were incorporated into the level-2 intercept (β_{0i}).

Other variables with the exception of training certificate were incorporated into the level-1 model and tested to determine the variance components. The models with only one component of variance (μ_{1i} *or* μ_{2i}) were better than the models with variance components of μ_{1i}, μ_{3i} and μ_{2i}, μ_{3i}. When model of variance components μ_{1i} *and* μ_{2i} were compared to models with μ_{1i} or μ_{2i}, the differences in deviance statistics between the models—(2608-2564) = 44 and (2652-2564) = 88—exceeded the critical value, 7.81 of a χ^2 distribution on 3 *df* . In terms of the deviance statistics, the random linear and quadratic slope terms for the coefficients for work experience and the fixed slope terms for the match coefficient were preferred.

Table 4.26 Determination of Variance Component

[1]Var	No. of parameters	Deviance	[1]Var	No. of parameters	Deviance	[1]Var	No. of parameters	Deviance
μ_{1i}	4	2608	μ_{1i}, μ_{2i}	7	2564	μ_{1i}, μ_{2i}, μ_{3i}	Not enough degrees of freedom	
μ_{3i}	4	2648	μ_{1i}, μ_{3i}	7	2602			
μ_{2i}	4	2652	μ_{2i}, μ_{3i}	7	2646			

Note. [1] Variance includes random intercept (μ_{0i})

$$Ln\ W_{ti} = \beta_{0i} + \beta_{1i}(Exp) + \beta_{2i}(Exp\text{-}Squared) + \beta_{3i}(Match) + e_{ti}$$

$$\beta_{0i} = \gamma_{00} + \sum_{q=1}^{3} \gamma_{oq} \overline{X}_{qi} + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$

$$\beta_{2i} = \gamma_{20} + \mu_{2i}$$

$$\beta_{3i} = \gamma_{30} + \mu_{3i}$$

However, the coefficient for quadratic work experience was not significant. Therefore, quadratic work experience was specified with 'no intercept model' (Raudenbush & Bryk, 2002, p. 172). That is, the coefficient for quadratic work experience (π_{2i}) was constrained to 0 and had only a random effect. The temporal model for level-1 and its variance component (*the full model*) was as follows:

$$Ln\ W_{ti} = \beta_{0i} + \beta_{1i}(Exp)_{ti} + \beta_{2i}(Exp\text{-}Squared)_{ti} + \beta_{3i}(Match)_{ti} + e_{ti}$$

$$\beta_{0i} = \gamma_{00} + \sum_{q=1}^{3} \gamma_{oq} \overline{X}_{qi} + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$

$$\beta_{2i} = \quad + \mu_{2i}$$

$$\beta_{3i} = \gamma_{30}$$

4.4.2.3. Test for Cohort Effects

The work-experience ∗ cohort interaction effects were examined for the level-1 model. Three dummy variables (D_{si}, $s = 1, 2, and\ 3$) representing cohort membership with Cohort 4 as a reference group were incorporated into the level-2 model. Tests were conducted by applying multiparameter tests for each level-1 slope specified with cohort membership.

$$Ln\ W_{ti} = \beta_{0i} + \beta_{1i}(Exp)_{ti} + \beta_{2i}(Exp\text{-}Squared)_{ti} + \beta_{3i}(Match)_{ti} + e_{ti}$$

$$\beta_{0i} = \gamma_{00} + \sum_{s=1}^{3} \gamma_s D_{si} + \sum_{q=4}^{6} \gamma_{oq} \overline{X}_{qi} + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \sum_{s=1}^{3} \gamma_s D_{si} + \mu_{1i}$$

$$\beta_{2i} = \quad \sum_{s=1}^{3} \gamma_s D_{si} + \mu_{2i}$$

$$\beta_{3i} = \gamma_{30} + \sum_{s=1}^{3} \gamma_s D_{si}$$

Results revealed that cohort membership is only significant as a predictor for slope of linear work experience (β_{1i}). However, the difference (6=8223-8217) in deviance statistics between models with or without cohort membership did not satisfy the critical value for χ^2 distribution with 3 degrees of freedom (p = .11), suggesting that inclusion of cohort membership does not improve explanation of the model. The model reflected test results for level-1 predictors; the cohort effect was as follows.

$$Ln\ W_{ti} = \beta_{0i} + \beta_{1i}(Exp)_{ti} + \beta_{2i}(Exp\text{-}Squared)_{ti} + \beta_{3i}(Match)_{ti} + e_{ti}$$

$$\beta_{0i} = \gamma_{00} + \sum_{q=1}^{3} \gamma_{oq} \overline{X}_{qi} + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$

$$\beta_{2i} = \quad \mu_{2i}$$

$$\beta_{3i} = \gamma_{30}$$

4.4.2.4. Multiparameter Test and Model Construction

To investigate the effects of job-education match on the relationship between level-2 variables and hourly wage rates, the level-1 model without job-education match (β_{3i}) (*the reduced model*) was fit first.

To determine the subsets of the level-2 variables needed in the level-2 equation, multiparameter tests and deviance statistics using full maximum likelihood were applied to the reduced model. Results suggested that course of study during high school, cooperative program, and employment in high school needed to be included in the level-2 model intercept. The final model was specified as follows:

$$Ln\ W_{ti} = \beta_{0i} + \beta_{1i}(Exp)_{ti} + \beta_{2i}(Exp\text{-}Squared)_{ti} + e_{ti}$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01\sim02}\,(Mean\ Value\ for\ Work\ Exp\ and\ Squared\ work\ exp) +$$
$$\gamma_{03\sim06}\,(Dummy\ for\ Race) + \gamma_{07}\,(Gender) +$$
$$\gamma_{07\sim010}\,(Dummy\ for\ HS\ Study\ of\ Course) + \gamma_{011}\,(Cooperative) +$$
$$\gamma_{012}\,(HS\ Employment) + \mu_{0i}$$

$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$

$$\beta_{2i} = \quad \mu_{2i}$$

4.4.2.5. Results for Models without Job-Education Match in Level-1 Model (reduced model)

Table 4.27 present the results for the reduced model. The variance components in the unconditional model (Model 1) demonstrated that there was enough variation for further study and that the intraclass correlation coefficient was .27 {= 2.18 /(6.00 + 2.18)}, indicating that one-quarter of the variation in hourly wage rates occurred between individuals. The intercept (γ_{00}) in Model 1, which is the overall log hourly wage rates across individuals, was around 6.17 in 2000: about $4.78 in 2006 dollar values. When the level-1 explanatory variables in model 2 were incorporated, the level-1 variables explained 39% of variance within-individuals {.39 = (6.00 – 3.66) /6.00}. The linear term (γ_{10}) for work experience, the components for the base-line for log hourly wage rates, was significant. A one-year increase in work experience above individual mean value increased log hourly wage rates by 33%. The variance component for the quadratic term (β_{2i}) was significant, implying that the acceleration rate for log hourly wage rates varied across individuals. Model 3 showed that control variables such as race and gender did not have a significant relationship with log hourly wage rates, indicating that wage inequality by race and gender does not exist in the early stages of labor market entry.

Models 4–6 present results for study of course in high school, participation in cooperative program, and high school employment were incorporated into Model 3. The coefficient for the comprehensive course (γ_{07}) in Model 4, which is the difference between the comprehensive course and the general course in log hourly wage rates, is .45, which means that workers who took the comprehensive course in high school received hourly wage rates 45 % greater than those of workers who took the

Table 4.27 Results for Models Without Job-education Match in Level-1

	Model-1		Model 2 (Work Exp.)		Model 3 (Race & gender)		Model 4 (Course of study)		Model 5 (Cooperative)		Model 7 (HS emp.)	
Fixed Effect	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Individual mean status, β_{0i}												
Intercept, γ_{00}	6.17 (.01)	.00	6.33 (.08)	.00	6.34 (.12)	.00	6.28 (.13)	.00	6.26 (.13)	.00	6.31 (.12)	.00
Mean work exp, γ_{01}			-.54 (.36)	.14	-.57 (.36)	.12	-.54 (.36)	.13	-.51 (.36)	.15	-.64 (.36)	.07
Mean squared work exp, γ_{02}			.08 (.06)	.19	.09 (.06)	.16	.08 (.06)	.18	.08 (.06)	.20	.10 (.06)	.12
Black, γ_{03}					-.12 (.15)	.40	-.14 (.15)	.32	-.09 (.15)	.51	-.06 (.16)	.71
Hispanic, γ_{04}					.00 (.22)	.99	-.01 (.22)	.96	.05 (.22)	.82	.07 (.22)	.74
Other_race, γ_{05}					-.05 (.16)	.76	-.08 (.16)	.60	-.01 (.17)	.94	.02 (.17)	.93
Gender, γ_{06}					.04 (.12)	.73	.02 (.12)	.86	.02 (.12)	.84	.01 (.12)	.93
College_prep, γ_{07}							.26 (.16)	.11				
Voca, γ_{08}							.02 (.21)	.93				
Comprehensive, γ_{09}							.45 (.10)	.00				
Other_course, γ_{010}							.85 (.51)	.10				
Cooperative, γ_{011}									.33 (.12)	.01		
HS employment, γ_{012}											.05 (.02)	.03
Mean growth rate, β_{1i}												
Intercept, γ_{10}			.33 (.06)	.00	.33 (.06)	.00	.33 (.06)	.00	.33 (.06)	.00	.33 (.06)	.00
Random effect	Var	*p*	Var	*p*	Var	*p*	Var	*p*	Var	*p*	Var	*p*
Level 1, e_{ti}	6.00		3.66		3.67		3.68		3.67		3.67	
Level 2, τ_{00}	2.18	.00	6.75	.00	6.78	.00	6.69	.00	6.73	.00	6.73	.00
τ_{10}			.64	.00	.64	.00	.62	.00	.63	.00	.63	.00
τ_{20}			.67	.00	.67	.00	.66	.00	.67	.00	.66	.00

general course in high school. Course of study in high school explained 1.4% of variance between individuals compared to Model 3. In Model 5, cooperative program was added to Model 3. The coefficient for cooperative program (γ_{07}) was .33, signifying that participation in cooperative programs in high school increased the hourly wage rates by an average of 33%. This variable explained additional 1% of the variance between individuals. Employment in high school was incorporated into Model 6. The coefficient for employment in high school (γ_{07}) was .04. A unit increase in hours worked in high school, which corresponded to 1,000 hours, enhanced the hourly wage rates by an average of 5%. Employment in high school explained 1% of variances among young workers. When all three variables were included in the equation (see Model 7, Table 4.27), the coefficients did not differ much from results provided above.

4.4.2.6. Results for Models with Job-Education Match in Level-1 Model (full model)

To examine how the job-education match affects the relationship between these three variables and log hourly wage rates, job-education match was added to the level-1 model of the reduced model. Its random effect was constrained to 0. The full model tested was as follows:

$$Ln\ W_{ti} = \beta_{0i} + \beta_{1i}(Exp) + \beta_{2i}(Exp\text{-}Squared) + \beta_{3i}(Match) + e_{ti}$$

$$\beta_{0i} = \gamma_{00} + \gamma_{01\sim03}\,(Dummy\ for\ Race) + \gamma_{04}\,(Gender) +$$
$$\gamma_{05\sim07}\,(Dummy\ for\ HS\ Study\ of\ Course) + \gamma_{08}\,(Cooperative) +$$
$$\gamma_{09}\,(HS\ Employment) + \mu_{0i}$$
$$\beta_{1i} = \gamma_{10} + \mu_{1i}$$
$$\beta_{2i} = \qquad \mu_{2i}$$
$$\beta_{3i} = \gamma_{30}$$

Table 4.28 Results for Models with Job-education Match in Level-1

	Model 3 (Race & gender)		Model 7 (HS exp.)		Model 8 (HS exp. + match)	
Fixed Effect	*β* *(SE)*	*p*	*β* *(SE)*	*p*	*β* *(SE)*	*p*
Individual mean status, β_{0i}						
Intercept, γ_{00}	6.34 (.12)	.00	6.21 (.14)	.00	6.74 (.04)	.00
Mean work exp, γ_{01}	-.57 (.36)	.12	-.58 (.36)	.11	.03 (.13)	.80
Mean squared work exp, γ_{02}	.09 (.06)	.16	.09 (.06)	.16	.01 (.02)	.66
Mean match, γ_{03}					.20 (.08)	.01
Black, γ_{04}	-.12 (.15)	.40	-.06 (.15)	.73	-.03 (.05)	.52
Hispanic, γ_{05}	.00 (.22)	.99	.09 (.23)	.68	.01 (.06)	.86
Other_race, γ_{06}	-.05 (.16)	.76	.01 (.16)	.96	.01 (.08)	.85
Gender, γ_{07}	.04 (.12)	.73	-.02 (.13)	.89	.11 (.04)	.01
College_prep, γ_{08}			.22 (.16)	.18	.00 (.06)	.98
Voca, γ_{09}			-.09 (.21)	.69	-.01 (.07)	.13
Comprehensive, γ_{010}			.35 (.10)	.00	-.02 (.05)	.73
Other_course, γ_{011}			.95 (.51)	.06	.63 (.47)	.18
Cooperative, γ_{012}			.28 (.13)	.03	.01 (.05)	.79
HS employment, γ_{013}			.04 (.02)	.04	.03 (.01)	.00
Mean growth rate, β_{1i}						
Intercept, γ_{10}	.33 (.06)	.00	.33 (.06)	.00	.11 (.01)	.00
Mean slope for match, β_{3i}						
Intercept, γ_{30}					.07 (.04)	.05
Random effect	Var	*p*	Var	*p*	Var	*p*
Level 1, e_{ti}	3.67		3.68		.13	
Level 2, τ_{00}	6.78	.00	6.62	.00	.18	.00
τ_{10}	.64	.00	.63	.00	.04	.00
τ_{20}	.67	.00	.65	.00	.03	.00

Table 4.28 presents the results for the full model with job-education match in Model 8, contrasted with the results for the reduced model without job-education match in Model 7. Model 8 shows a positive relationship between job-education match and log hourly wage rates, conditional on three variables in Model 7. The job-education match increased hourly wage rates by 7%. Mean job-education match, the proportion of job-education match across years of work experience after high school graduation, was significant. The higher the proportion of job-education match in individuals' work experience, the higher the hourly wage rates received by individual workers. This suggests that longer periods of job-education match increase hourly wage rates. More importantly, including the job-education match in the level-1 model reduced 97% and 96% of variations in the level-1 and -2 models, compared to Model 3. Of special interest is that inclusion of job-education match reduced the contribution of the comprehensive course and participation in cooperative program in high school to nonsignificance—$p = .73$ and $p = .79$, respectively—and made those coefficient considerably smaller. This implies that the job-education match mediates the link between two variables and the log hourly wage rates. However, employment in high school remains significant and positively related to log hourly wage rates. By including job-education match, gender differences in wage rates become positive and significant ($\gamma_{04} = .11$, $p = .01$).

4.4.2.7. Mediation Effect of Job-Education Match

Considering the results in sections 4.2.2 and 4.2.6, job-education match appears to mediate the relationship between a training certificate and hourly wage rates, the relationship between high school course of study and hourly wage rates, the relationship between cooperative program and hourly wage rates, and the relationship between gender and hourly wage rates

Chapter 5

Summary, Discussion, Implications, and Recommendations

The objective of this study was to explore the effect of experience in high school on the job-education match and log hourly wage rates after controlling for demographic characteristics and human capital endowment after high school graduation. This study targeted only work-bound students in high school, who had never enrolled in school for further study three to six years after high school graduation. Predictors included transition-related variables related to support, awareness, and skills for transition-to-work. Data were collected from NLSY 97. Analysis was conducted on two dimensions: cross-sectional and longitudinal. This chapter provides a summary of findings, discussion, implications, and recommendations for future research.

5.1 Summary of Findings

5.1.1 Research Question One: Factors Related to Job-Education Match from Cross-Sectional Analysis

Descriptive statistics showed a average tendency toward job-education match, log hourly wage rates, predictors, and covariates. The cross-sectional analyses related to job-education match revealed a strong association between participation in cooperative programs and job-education match. High self-esteem also significantly contributed to job-education match. Comprehensive course of study in high school played an important role in achieving a job equivalent to one's education in the analysis of two waves, but size and statistical significance were adjusted considerably by other predictors such as cooperative programs, employment in high school, and self-esteem. Parents with less than a high school education and cognitive ability were negatively related to job-education match, but significant in the analysis of only one wave. Employment in high school increased the odds of job-education match but was significant only in the analysis of one wave. The results for the ordinal logistic regression were very similar to those for the binary logistic regression except for the effect of parent education less than high school. Participation in cooperative programs and high self-esteem consistently enhanced the probability of being employed in higher-level jobs. Employment in high school was significant in the analyses of two waves. Parental education less than high school significantly reduced the possibility of having higher-level jobs across waves.

5.1.2 Research Question Two: Factors Related to Log Hourly Wage Rates from Cross-Sectional Analysis

Accumulated work experience, including work experience during and after high school, significantly increased log hourly wage rates of jobs obtained after high school graduation. Higher self-esteem was associated with higher hourly wage rates, but cognitive ability lowered hourly wage rates. Parent education less than high school lowered hourly wage rates attained by children after high school graduation. Cooperative program involvement increased log hourly wage rates, but was significant only in one analysis.

5.1.3 Research Question Three: Relationship between Job-Education Match and Hourly Wage Rates from Cross-Sectional Analysis

Job-education match was strongly related to log hourly wage rates, even after adjustment for transition-related predictors and control variables. Inclusion of job-education match into the model changed considerably the size and statistical significance of the relationship between transition-related variables and log hourly wage rates. The best subset models for testing the mediating role of job-education match revealed that other independent variables, such as parent education less than high school, self-esteem, participation in a cooperative program, and a training certificate, could be removed from the model to predict log hourly wage rates. This indicates that the effects of these transition-related variables on hourly wage rates job-education are mediated through job-education match.

5.1.4 Research Question Four: Relationship between Transition-related Variables and Job-Education Match and Hourly Wage Rates from Growth Model Analysis

Descriptive statistics showed that job-education match and log hourly wage rates are a function of work experience. Growth model analysis demonstrated that job-education match was convergent with time; the probability of job-education match was enhanced along an arch-shaped trajectory as years of work experience increased; and a training certificate increased the probability of job-education match by shifting the trajectory upward. Parental education less than high school decreased the average status of job-education match across years of work experience. Participation in cooperative programs, employment in high school and self-esteem increased the probability of job-education match across work experience considered in this research, i.e., up to six years after high school graduation. Comprehensive course of study in high school significantly enhanced the probability of job-education match, but other experience during high school, such as cooperative programs and employment, adjusted for this. Meanwhile, the growth rate for job-education match was influenced by tech-prep programs. Participation in tech-prep programs decreased the probability of job-education match right after high school graduation but increased it at a later stage of work. The effect of mentoring program on job-education match depended on whether or not respondents obtained a training certificate after entering the labor market.

Another growth model analysis for log hourly wage rates showed that the trajectory for log hourly wage rates had a linear rather than a quadratic relationship with work experience. Comprehensive course of study, cooperative programs, and employment in high school increased the average log hourly wage rates across work experiences during periods considered in this research. i.e., up to six years after high school graduation. Inclusion of job-education match as a predictor for log hourly wage rates into a model changed the relationship of comprehensive course of study, cooperative programs, and training certificates with log hourly wage rates. This was indicative of the mediating role of job-education match for those relationships. In addition, job-education match itself had a significant effect on log hourly wage rates and explained most of the variances for log hourly wage rates within and between individuals.

5.2 Limitations

This study revealed some discrepancies between the cross-sectional study and the growth model; these occurred in the areas relating to the effects of parent education less than high school and cognitive ability on job-education match and the effects of comprehensive course of study, self-esteem, and cognitive ability on log hourly wage effects. These may be due to limitations of the cross-sectional study. First, even though work experience was incorporated into the cross-sectional study, the cross-sectional study could not separate intra-individual changes from inter-individual changes, which is an advantage of growth modeling. Therefore, the cross-sectional design may fail to identify the change in job-education match and log hourly wage rates caused by experience in high school. Second, as related to the first limitation, the cross-sectional study revealed a difficulty in identifying the interaction of time variant variables such as work experience and a training certificate with time invariant high school experiences such as participation in tech-prep and mentoring programs. Only longitudinal analysis allowed the estimation of unbiased interaction effects by separating intra-individual changes from inter-individual changes.

5.3 Discussion and Recommendations for Future Research

How can parents with less than a high school education decrease the probability of their children's job-education match? Contrary to Warren, Sheridan and Hauser's suggestion (2002) about the indirect effect of parent education on job status through children's education, and Farkas et al.'s (1997) and Rosenbaum's (2001) assertion that parental background does not affect early jobs, this study demonstrated that lower parent education had a significant effect on children's job-education match six years after high school graduation, after controlling for children's education. Specifically, the results of the ordinal logistic regression demonstrated that lower parent education severely restricted children's job status. Other research imparts two possible interpretations. First, the lack of networks for those parents may have restricted the availability of more decent jobs for their children. Most job-related information, especially that pertaining to low-skilled jobs, is transmitted through social networks that include friends and relatives (Waldinger & Licher, 2003). Groups who lack a social network face high competition for each position (Rosenbaum, 2001). Research (Addison & Portugal, 2002; Granovetter, 1995) suggests that informal methods such as personal referrals are the most effective ways to acquire a job. Parents' limited social networks put their children at a disadvantage when they seek to obtain an offer for a decent job. However, this hypothesis was not tested in this research. Second, the information divide between parents who experienced the same transition and those who did not may play an important role in conveying the support, awareness, and skills for the transition. Given that the coefficient of lower parental education in all analyses was slightly influenced by predictors relating to experience in high school, such as course of study in high school, employment in high school, and school-to-work programs, and was considerably affected by children's self-esteem, the information divide may be a main reason for the difference in job-education match. More research should be conducted on this issue.

A comprehensive course of study had a significant effect on job-education match and log hourly wage rates. Size and statistical significance in former effects were reduced by school-to-work programs and employment in high school. So far, most previous studies have focused on the vocational curriculum and why it has not served its manifest purpose. i.e., labor market advantage. Research suggests that a small proportion of vocational program graduates have found jobs related to programs taught in high school, which gives them a labor market advantage (Bishop, 1989; Grubb & Lazerson, 2004).

However, many employers have emphasized that high schools should put more energy into enhancing students' general skills, such as mathematics and problem-solving, rather than specific skills for entry-level jobs. However, it is not clear whether the positive effects of comprehensive courses of study in this research are due to the course of study itself or pre-existing differences between those who were pursuing this course and those who were not. According to Delci and Stern (1999), students in comprehensive courses had better school attendance rates and higher grades than vocational students. In addition, students in comprehensive programs were similar to vocational students in taking school-to-work programs and to general students in taking academic courses (Stone III, 2002). These findings were indicative of sample selection bias. This study also raised the difference in self-esteem between comprehensive course takers and students pursuing other programs. The coefficients of a comprehensive course of study in all analyses of job-education match were adjusted for self-esteem. This implies a pre-existing difference for students taking comprehensive courses. Further study is needed on this issue, considering the sample selection bias.[8]

Cooperative programs, which are a combination of participation in morning school classes and employment in the afternoon, had a strong positive effect on job-education match and log hourly wage rates. Their effect on log hourly wage rates was mediated through job-education match. Previous studies (Neumark & Rothstein, 2006) investigating the effect of cooperative programs pointed out the positive relationship with employment and no selection bias for this relationship. Cooperative programs' positive effect on employment could be a necessary result, given that they involve employment

[8] Heckman's tools for sample selection bias are for a linear regression, not for multilevel (HLM) modeling. Bushway, Johnson, and Slocum (2007) pointed out that previous studies applying Heckman's tool for multilevel modeling may be problematic.

outside school; employment after high school could be an extension of employment related to cooperative programs. Then, how do cooperative programs increase the probability of job-education match and wage rates through job-education match? Figure 2.1, the human capital framework, provides three plausible explanations: channeling through skill, knowledge and behavior. Given that school-to-work programs focus on the application of what students learn in school to real work, cooperative programs may help students develop useful skills and knowledge or proper behavior productive to jobs. Considering that a few of those who pursue the vocational track in high school have jobs they were trained for in school, cooperative programs may work as a motive for students to recognize employers' needs. Meanwhile, network theory (Rosenbaum, 2001) provides other plausible explanations. That is, reliable contracts and frequent monitoring, which cooperative programs include, may help students to find a high-quality job and to sustain employment in higher-status jobs. This issue also requires further research.

The interaction effects among tech-prep programs, work experience, and mentoring programs with a training certificate were only presented in the growth model analysis. At the onset of labor market entry, the probability of job-education match for those participating in tech-prep programs was lower than that for non-tech-prep course takers. The lower probability at an early stage of work for students who participated in tech-prep programs may be due to tech-prep programs' original purpose, i.e., two-year college-preparation for work-bound students. That is, sampled respondents who were not enrolled in two-year colleges and may have failed tech-prep programs may miss the opportunity to gain entry-level skills or knowledge. This may result in a lower probability of job-education match. However, further research needs to be conducted about how their job-education match probability increased in the long run.

Mentoring programs (also, job shadowing, school enterprise) showed interaction effects with a training certificate. In light of the fact that participants in mentoring programs tended to be less committed and motivated for preparation for work (Stern, Finkelstein, Stone, Latting, & Dornsife, 1995), the effects of mentoring programs implemented in a school-to-work context might be influenced considerably by the extent of the mentee's motivation and readiness for work. Neumark and Rothstein (2006) found that mentoring, job shadowing, and school enterprise were positively related to enrollment in college and were not significant but were negatively related to employment. Non-participants in mentoring programs, who may be relatively more motivated to be prepared for work, may exhibit a higher probability of job-education match by attaining a training certificate, which could give them an advantage in obtaining higher-status jobs. Meanwhile, participants in mentoring programs who were less motivated to work after high school graduation seemed to benefit from mentoring programs and achieved a higher probability of job-education match. However, those who participated in mentoring programs and obtained a training certificate after high school graduation may not benefit from mentoring programs and may be less oriented toward work so that they may need to obtain an additional skill to be attractive to employers[9]. If so, workers in this group may demonstrate the lowest probability of job-education match. However, further studies need to be conducted on how mentoring programs work with respect to achieving job status.

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[9] Cross-sectional analyses for log hourly wage rates showed the same pattern for those respondents: significantly negative interaction effects of mentoring program and a training certificate on log hourly wage rates.

Previous studies on employment in high school have offered contradictory results relating to labor market outcomes. Marsh and Kleitman (2005) and Steel (1991) asserted that employment in high school reduced occupational aspirations. Ruhm (1997) suggested that high school work yields benefits ten years after high school graduation. However, the results of ordinal logistic regression showed that hours worked in high school are positively related to higher job status in analyses of the two waves. Furthermore, longitudinal employment in high school enhanced significantly the probability of job-education match and log hourly wage rates, even after controlling for other transition-related variables, such as course of study, school-to-work programs, work experience after high school graduation, and a training certificate. Unlike other transition-related variables in which the effects on log hourly wage rates were mediated through job-education match, hours worked during high school showed an independent influence on log hourly wage rates. This indicated that employment in high school can offer an additional advantage in human capital formation in addition to such formal intervention strategies. The results are consistent with those from Mortimer's study (2003), which suggested that high school work builds the technical and social competences of work-bound students.

Higher self-esteem has a significant effect on job-education match. In addition, the ordinal measure of job-education match also showed the effects of higher self-esteem in analyses of the three waves. However, its effects on log hourly wage rates were not significant, even though previous longitudinal studies of adult high school workers demonstrated a significant advantage for hourly wage rates based on higher self-esteem (Kim & Baker, 2008). How does self-esteem measured in early adolescence increase the probability of job-education match six years after high school graduation? Research has demonstrated that self-esteem, defined as competence or worthiness (Mruk 2006), provides useful insight into predicting individual behavior. Researchers depict its capacity to predict human behavior as a self-fulfilling prophecy arising from a mechanism seeking to maintain stability (Cambell & Lavallee, 1993; Mruk, 2006; Rosenberg, Schooler, &Schoenbach, 1989). That is, individuals tend to behave in a manner that is consistent with their perceived competence or worthiness of self. Roberts and Bengtson (1996) contended that self-esteem in adolescents and young adults remains fairly stable across the next several decades of adult life (p. 83), suggesting that competence and aspirations formed in the early stages of life have a consequence for later life events, and thereby self-esteem in young adulthood is related to competence and aspiration during the period in which they are being raised by their parents. These general explanations of self-esteem reveal how self-esteem influences job-education match; to maintain their worthiness, workers with high self-esteem incessantly balance job-status with their education or exceed job-status levels over their education.

Unlike Scherer's concern (2005) that bad jobs at an early stage of the labor market experience could cause permanent damage, it was demonstrated here that as work experience accumulates, young workers find jobs that match their education; on average, 85% of workers held jobs that matched their education level. The initial status of job-education match depends on diverse types of incidents experienced by influencing workers during high school: parent education level, courses of study in high school, school-to-work programs, and self-esteem. The speed of job-education match could be changeable depending on specific school-to-work programs, such as tech-prep and mentoring (including job shadowing and school enterprise). The effects of a training certificate on job-education match and log hourly wage rates demonstrate that a lack of experience during high school could be mitigated by efforts made after entering the labor market.

5.4 Policy Implications

Many studies of early labor market outcomes for high school-educated workers imply that young workers initially proceed to randomly gather work experiences and after a time find appropriate jobs and increase their wage rates (Rosembaum, 2003). Other opposition to vocational education, based on John Dewey's statements against curriculum differentiation, suggests that early concentration in a specific occupation could limit each student's potential (Grubb & Lazerson, 2004). Another weakness of vocational education stems from the contradictory results relating to economic outcomes (Garddecki& Neumark, 1998). These opinions and the lack of economic evidence have led to the conclusion that vocational interventions for high school students may be useless. The only reason to support vocational education lies in its educational purpose, i.e., prevention of high school dropout. Many high school indicators have shifted toward school completion and college enrollment rates. High schools' accountability for preparing students for work and their future lives has been pushed into a corner. Since the federal School-to-Work Opportunities Act failed to gain reauthorization in 2000, funds for school-to-work programs have substantially decreased at the state level.

In light of the prevalence of arguments against vocational education, the findings from this study may only provide minimal support for high schools' role in preparing students for jobs that they will soon face. In this study we included job-education match as a labor market outcome of high school experience and demonstrated that job-education match may be facilitated and that jobs that require more than a high school diploma could be achieved. More importantly, the economic outcome, log hourly wage rates, may be enhanced by a mediation of job-education match facilitated by experience in high school. This implies that it is worthwhile to continue to offer vocational programs to students in high school.

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Appendix A

Job Zone Distinctions and Standard Occupational Classification (SOC) Equivalents for the NLSY 97 Occupational Codes

Table A. *Job Zone Distinctions and Standard Occupational Classification (SOC) Equivalents for the NLSY 97 Occupational Codes*

Code	Occupational title	SOC equivalent	[a]Job zone
	Executive, Administrative, and Managerial Occupations (0010-0430)		
10	Chief Executives	11-1011	5
20	General and Operations Mangers	11-1021	4
40	Advertising and Promotions Managers	11-2011	4
50	Marketing and Sales Managers	11-2020	4
100	Administrative Services Managers	11-3011	4
110	Computer and Information Systems Managers	11-3021	5
120	Financial Managers	11-3031	4, 5
130	Human Resources Managers	11-3040	*nd*
150	Purchasing Managers	11-3061	4
160	Transportation, Storage, and Distribution Managers	11-3071	3
210	Farmers and Ranchers	11-9012	3
220	Construction Managers	11-9021	3
230	Education Administrators	11-9030	*nd*
310	Food Service Managers	11-9051	3
340	Lodging Managers	11-9081	3
350	Medical and Health Services Managers	11-9111	5
410	Property, Real Estate, and Community Association Managers	11-9141	3
420	Social and Community Service Managers	11-9151	4
430	Managers, All Other	11-9199	*nd*

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Management Related Occupations (0500-0730)		
500	Agents and Business Managers of Artists, Performers, and Athletes	13-1011	4
520	Wholesale and Retail Buyers, Except Farm Products	13-1022	3
530	Purchasing Agents, Except Wholesale, Retail, and Farm Products	13-1023	3
540	Claims Adjusters, Appraisers, Examiners, and Investigators	13-1030	3
560	Compliance Officers, Except Agriculture, Constructions, Health and Safety, and Transportation	13-1041	2,3,4,5
620	Human Resources, Training, and Labor Relations Specialists	13-1070	*
700	Logisticians	13-1081	4
710	Management Analysts	13-1111	4
720	Meeting and Convention Planners	13-1121	4
730	Other Business Operations Specialists	13-11XX	*nd*
800	Accountants and Auditors	13-2011	4
830	Credit Analysts	13-2041	4
850	Personal Finance Advisors	13-2052	4
860	Insurance Underwriters	13-2053	3
900	Financial Examiners	13-2061	4
910	Loan Counselors and Officers	13-2070	3
930	Tax Examiners, Collectors, and Revenue Agents	13-2081	3
940	Tax Preparers	13-2082	3
950	Financial Specialists, All Other	13-2099	*nd*

Mathematical and Computer Scientists (1000-1240)

1010	Computer Programmers	15-1021	4

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
1020	Computer Software Engineers	15-1030	4
1040	Computer Support Specialists	15-1041	3
1060	Database Administrators	15-1061	4
1100	Network and Computer Systems Administrators	15-1071	4
1110	Network Systems and Data Communications Analysts	15-1081	3
1220	Operations Research Analysts	15-2031	5
1230	Statisticians	15-2041	5

Engineers, Architects, and Surveyors (1300-1530)

1300	Architects, Except Naval	17-1010	5
1310	Surveyors, Cartographers, and Photogrammetrists	17-1020	*nd*
1320	Aerospace Engineers	17-2011	5
1350	Chemical Engineers	17-2041	4
1360	Civil Engineers	17-2051	4
1410	Electrical and Electronics Engineers	17-2070	4
1420	Environmental Engineers	17-2081	5
1450	Materials Engineers	17-2131	4
1460	Mechanical Engineers	17-2141	4
1530	Engineers, All Other	17-2199	4

Engineering and Related Technicians (1540-1560)

1540	Drafters	17-3010	4
1560	Surveying and Mapping Technicians	17-3031	3

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Physical Scientists (1600-1760)		
1600	Agricultural and Food Scientists	19-1010	5
1710	Atmospheric and Space Scientists	19-2021	4
1760	Physical Scientists, All Other	19-2099	4
	Social Scientists and Related Workers (1800-1860)		
1810	Market and Survey Researchers	19-3020	4
1860	Miscellaneous Social Scientists and Related Workers	19-3090	4
	Life, Physical, and Social Science Technicians (1900-1960)		
1900	Agriculture and Foods Science Technicians	19-4011	3
1910	Biological Technicians	19-4021	4
1920	Chemical Technicians	19-4031	3
1930	Geological and Petroleum Technicians	19-4041	3, 4
1960	Other Life, Physical, and Social Science Technicians	19-40XX	4
	Counselors, Social, and Religious Workers (2000-2060)		
2000	Counselors	21-1010	4
2010	Social Workers	21-1020	4
2020	Miscellaneous Community and Social Service Specialists	21-1090	4
2040	Clergy	21-2011	5
2060	Religious Workers, All Other	21-2099	*nd*
	Lawyers, Judges, and Legal Support Workers (2100-2150)		
2100	Lawyers	23-1011	5

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
2140	Paralegals and Legal Assistants	23-2011	3
2150	Miscellaneous Legal Support Workers	23-2090	3
	Teachers (2200-2340)		
2200	Postsecondary Teachers	25-1000	5
2300	Preschool and Kindergarten Teachers	25-2010	3
2310	Elementary and Middle School Teachers	25-2020	4
2320	Secondary School Teachers	25-2030	4
2330	Special Education Teachers	25-2040	4
2340	Other Teachers and Instructors	25-3000	3
	Education, Training, and Library Workers (2400-2550)		
2400	Archivists, Curators, and Museum Technicians	25-4010	4
2430	Librarians	25-4021	5
2440	Library Technicians	25-4031	3
2540	Teacher Assistants	25-9041	3
	Entertainers and Performers, Sports and Related Workers (2600-2760)		
2600	Artists and Related Workers	27-1010	3
2630	Designers	27-1020	4
2700	Actors	27-2011	2
2710	Producers and Directors	27-2012	4
2720	Athletes, Coaches, Umpires, and Related Workers	27-2020	3
2740	Dancers and Choreographers	27-2030	3
2750	Musicians, Singers, and Related Workers	27-2040	2, 3

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
2760	Entertainers and Performers, Sports and Related Workers, All Other	27-2099	*nd*
	Media and Communication Workers (2800-2960)		
2800	Announcers	27-3010	3
2810	News Analysts, Reporters and Correspondents	27-3020	4
2820	Public Relations Specialists	27-3031	4
2830	Editors	27-3041	4
2850	Writers and Authors	27-3043	4
2860	Miscellaneous Media and Communication Workers	27-3090	*nd*
2900	Broadcast and Sound Engineering Technicians and Radio Operators	27-4010	3
2910	Photographers	27-4021	3
2920	Television, Video, and Motion Picture Camera Operators and Editors	27-4030	3
	Health Diagnosing and Treating Practitioners (3000-3260)		
3030	Dietitians and Nutritionists	29-1031	5
3050	Pharmacists	29-1051	5
3120	Podiatrists	29-1081	5
3130	Registered Nurses	29-1111	3
3160	Physical Therapists	29-1123	5
3220	Respiratory Therapists	29-1126	3
3230	Speech-Language Pathologists	29-1127	5
3240	Therapists, All Other	29-1129	*nd*
3250	Veterinarians	29-1131	5

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Health Care Technical and Support Occupations (3300-3650)		
3300	Clinical Laboratory Technologists and Technicians	29-2010	2
3320	Diagnostic Related Technologists and Technicians	29-2030	3
3400	Emergency Medical Technicians and Paramedics	29-2041	2
3410	Health Diagnosing and Treating Practitioner Support Technicians	29-2050	3
3500	Licensed Practical and Licensed Vocational Nurses	29-2061	3
3510	Medical Records and Health Information Technicians	29-2071	3
3520	Opticians, Dispensing	29-2081	3
3530	Miscellaneous Health Technologists and Technicians	29-2090	*nd*
3540	Other Healthcare Practitioners and Technical Occupations	29-9000	*nd*
3600	Nursing, Psychiatric, and Home Health Aides	31-1010	2
3630	Massage Therapists	31-9011	3
3640	Dental Assistants	31-9091	2
3650	Medical Assistants and Other Healthcare Support Occupations	31-909X	*nd*

	Protective Service Occupations (3700-3950)		
3740	Fire Fighters	33-2011	2, 3
3750	Fire Inspectors	33-2020	3
3800	Bailiffs, Correctional Officers, and Jailers	33-3010	2
3850	Police and Sheriff's Patrol Officers	33-3051	3
3900	Animal Control Workers	33-9011	2
3920	Security Guards and Gaming Surveillance Officers	33-9030	2
3940	Crossing Guards	33-9091	1
3950	Lifeguards and Other Protective Service Workers	33-909X	*nd*

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Food Preparation and Serving Related Occupations (4000-4160)		
4000	Chefs and Head Cooks	35-1011	3
4010	First-Line Supervisors/Managers of Food Preparation and Serving Workers	35-1012	2
4020	Cooks	35-2010	1
4030	Food Preparation Workers	35-2021	1
4040	Bartenders	35-3011	2
4050	Combined Food Preparation and Serving Workers, Including Fast Food	35-3021	1
4060	Counter Attendants, Cafeteria, Food Concession, and Coffee Shop	35-3022	1
4110	Waiters and Waitresses	35-3031	1
4120	Food Servers, Nonrestaurant	35-3041	1
4130	Dining Room and Cafeteria Attendants and Bartender Helpers	35-9011	1
4140	Dishwashers	35-9021	1
4150	Hosts and Hostesses, Restaurant, Lounge, and Coffee Shop	35-9031	1

	Cleaning and Building Service Occupations (4200-4250)		
4200	First-Line Supervisors/Managers of Housekeeping and Janitorial Workers	37-1011	3
4210	First-Line Supervisors/Managers of Landscaping, Lawn Service, and Groundskeeping Workers	37-1012	2
4220	Janitors and Building Cleaners	37-2011 37-2019	1
4230	Maids and Housekeeping Cleaners	37-2012	1
4240	Pest Control Workers	37-2021	2
4250	Grounds Maintenance Workers	37-3010	*nd*

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Entertainment Attendants and Related Workers (4300-4430)		
4300	First-Line Supervisors/Managers of Gaming Workers	39-1010	3
4320	First-Line Supervisors/Managers of Personal Service Workers	39-1021	3
4350	Nonfarm Animal Caretakers	39-2021	2
4400	Gaming Services Workers	39-3010	2
4420	Ushers, Lobby Attendants, and Ticket Takers	39-3031	1
4430	Miscellaneous Entertainment Attendants and Related Workers	39-3090	1
	Personal Care and Service Workers (4460-4650)		
4500	Barbers	39-5011	3
4510	Hairdressers, Hairstylists, and Cosmetologists	39-5012	3
4520	Miscellaneous Personal Appearance Workers	39-5090	*nd*
4530	Baggage Porters, Bellhops, and Concierges	39-6010	1
4540	Tour and Travel Guides	39-6020	3
4550	Transportation Attendants	39-6030	2
4600	Child Care Workers	39-9011	2, 3
4610	Personal and Home Care Aides	39-9021	2
4620	Recreation and Fitness Workers	39-9030	4
4640	Residential Advisors	39-9041	3
4650	Personal Care and Service Workers, All Other	39-9099	*nd*
	Sales and Related Workers (4700-4960)		
4700	First-Line Supervisors/Managers of Retail Sales Workers	41-1011	2
4710	First-Line Supervisors/Managers of Non-Retail Sales Workers	41-1012	4
4720	Cashiers	41-2010	1

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
4740	Counter and Rental Clerks	41-2021	1
4750	Parts Salespersons	41-2022	2
4760	Retail Salespersons	41-2031	2
4800	Advertising Sales Agents	41-3011	3
4810	Insurance Sales Agents	41-3021	3
4820	Securities, Commodities, and Financial Services Sales Agents	41-3031	4
4830	Travel Agents	41-3041	3
4840	Sales Representatives, Services, All Other	41-3099	*nd*
4850	Sales Representatives, Wholesale and Manufacturing	41-4010	3
4900	Models, Demonstrators, and Product Promoters	41-9010	2
4920	Real Estate Brokers and Sales Agents	41-9020	2
4940	Telemarketers	41-9041	2
4950	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers	41-9091	2
4960	Sales and Related Workers, All Other	41-9099	*nd*

Office and Administrative Support Workers (5000-5930)

5000	First-Line Supervisors/Managers of Office and Administrative Support Workers	43-1011	3
5010	Switchboard Operators, Including Answering Service	43-2011	2
5020	Telephone Operators	43-2021	2
5030	Communications Equipment Operators, All Other	43-2099	*nd*
5100	Bill and Account Collectors	43-3011	2, 3
5110	Billing and Posting Clerks and Machine Operators	43-3021	2, 3
5120	Bookkeeping, Accounting, and Auditing Clerks	43-3031	3
5140	Payroll and Timekeeping Clerks	43-3051	3

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
5150	Procurement Clerks	43-3061	3
5160	Tellers	43-3071	2
5200	Brokerage Clerks	43-4011	3
5210	Correspondence Clerks	43-4021	2
5220	Court, Municipal, and License Clerks	43-4031	2, 3
5230	Credit Authorizers, Checkers, and Clerks	43-4041	2, 3
5240	Customer Service Representatives	43-4051	2
5250	Eligibility Interviewers, Government Programs	43-4061	3
5260	File Clerks	43-4071	3
5300	Hotel, Motel, and Resort Desk Clerks	43-4081	2
5310	Interviewers, Except Eligibility and Loan	43-4111	3
5320	Library Assistants, Clerical	43-4121	3
5330	Loan Interviewers and Clerks	43-4131	3
5350	Order Clerks	43-4151	2
5360	Human Resources Assistants, Except Payroll and Timekeeping	43-4161	3
5400	Receptionists and Information Clerks	43-4171	2
5410	Reservation and Transportation Ticket Agents and Travel Clerks	43-4181	2
5500	Cargo and Freight Agents	43-5011	2
5510	Couriers and Messengers	43-5021	2
5520	Dispatchers	43-5030	2
5530	Meter Readers, Utilities	43-5041	2
5540	Postal Service Clerks	43-5051	2
5550	Postal Service Mail Carriers	43-5052	2
5560	Postal Service Mail Sorters, Processors, and Processing Machine Operators	43-5053	2

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
5600	Production, Planning, and Expediting Clerks	43-5061	2
5610	Shipping, Receiving, and Traffic Clerks	43-5071	2
5620	Stock Clerks and Order Fillers	43-5081	*nd*
5630	Weighers, Measurers, Checkers, and Samplers, Recordkeeping	43-5111	2
5700	Secretaries and Administrative Assistants	43-6010	3
5800	Computer Operators	43-9011	3
5810	Data Entry Keyers	43-9021	2
5820	Word Processors and Typists	43-9022	2
5840	Insurance Claims and Policy Processing Clerks	43-9041	2
5850	Mail Clerks and Mail Machine Operators, Except Postal Service	43-9051	2
5860	Office Clerks, General	43-9061	2
5900	Office Machine Operators, Except Computer	43-9071	2
5910	Proofreaders and Copy Markers	43-9081	4
5920	Statistical Assistants	43-9111	3
5930	Office and Administrative Support Workers, All Other	43-9199	*nd*

Farming, Fishing, and Forestry Occupations (6000-6130)

Code	Occupational title	SOC equivalent	[a]Job zone
6000	First-Line Supervisors/Managers/Contractors of Farming, Fishing, and Forestry Workers	45-1010	*nd*
6040	Graders and Sorters, Agricultural Products	45-2041	1
6050	Other Agricultural Workers	45-2090 45-9099	1
6100	Fishers and Related Fishing Workers	45-3011	1
6120	Forest and Conservation Workers	45-4011	3
6130	Logging Workers	45-4020	*nd*

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Construction Trades and Extraction Workers (6200-6940)		
6200	First-Line Supervisor/Managers of Construction Trades and Extraction Workers	47-1011	3
6210	Boilermakers	47-2011	1
6220	Brickmasons, Blockmasons, and Stonemasons	47-2020	3
6230	Carpenters	47-2031	2, 3
6240	Carpet, Floor, and Tile Installers and Finishers	47-2040	2
6250	Cement Masons, Concrete Finishers, and Terrazzo Workers	47-2050	2
6260	Construction Laborers	47-2061	1
6320	Operating Engineers and Other Construction Equipment Operators	47-2073	3
6330	Drywall Installers, Ceiling Tile Installers, and Tapers	47-2080	2
6350	Electricians	47-2111	3
6360	Glaziers	47-2121	2
6400	Insulation Workers	47-2130	2
6420	Painters, Construction and Maintenance	47-2141	2
6440	Pipelayers, Plumbers, Pipefitters, and Steamfitters	47-2150	3
6460	Plasterers and Stucco Masons	47-2161	2
6500	Reinforcing Iron and Rebar Workers	47-2171	2
6510	Roofers	47-2181	2
6520	Sheet Metal Workers	47-2211	2
6530	Structural Iron and Steel Workers	47-2221	2
6600	Helpers, Construction Trades	47-3010	*nd*
6660	Construction and Building Inspectors	47-4011	3
6710	Fence Erectors	47-4031	2
6720	Hazardous Materials Removal Workers	47-4041	2

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
6730	Highway Maintenance Workers	47-4051	2
6760	Miscellaneous Constructions and Related Workers	47-4090	*nd*
6800	Derrick, Rotary Drill, and Service Unit Operators, Oil, Gas, and Mining	47-5010	2
6820	Earth Drillers, Except Oil and Gas	47-5021	2
6830	Explosives Workers, Ordnance Handling Experts, and Blasters	47-5031	2
6840	Mining Machine Operators	47-5040	*nd*
6940	Other Extraction Workers	47-50XX	*nd*

	Installation, Maintenance, and Repair's Workers (7000-7620)		
7000	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	49-1011	4
7010	Computer, Automated Teller, and Office Machine Repairers	49-2011	3
7020	Radio and Telecommunications Equipment Installers and Repairers	49-2020	3
7030	Avionics Technicians	49-2091	3
7040	Electric Motor, Power Tool, and Related Repairers	49-2092	3
7110	Electronic Equipment Installers and Repairers, Motor Vehicles	49-2096	3
7120	Electronic Home Entertainment Equipment Installers and Repairers	49-2097	3
7130	Security and Fire Alarm Systems Installers	49-2098	3
7140	Aircraft Mechanics and Service Technicians	49-3011	3
7150	Automotive Body and Related Repairers	49-3021	2
7200	Automotive Service Technicians and Mechanics	49-3023	3
7210	Bus and Truck Mechanics and Diesel Engine Specialists	49-3031	3
7220	Heavy Vehicle and Mobile Equipment Service Technicians and Mechanics	49-3040	2
7240	Small Engine Mechanics	49-3050	2

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
7260	Miscellaneous Vehicle and Mobile Equipment Mechanics, Installers, and Repairers	49-3090	2
7300	Control and Valve Installers and Repairers	49-9010	3
7310	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	49-9021	3
7330	Industrial and Refractory Machinery Mechanics	49-9041 49-9045	2, 3
7340	Maintenance and Repair Workers, General	49-9042	3
7350	Maintenance Workers, Machinery	49-9043	2
7360	Millwrights	49-9044	3
7410	Electrical Power-Line Installers and Repairers	49-9051	3
7420	Telecommunications Line Installers and Repairers	49-9052	2
7510	Coin, Vending, and Amusement Machine Servicers and Repairers	49-9091	2
7540	Locksmiths and Safe Repairers	49-9094	2
7550	Manufactured Building and Mobile Home Installers	49-9095	2
7560	Riggers	49-9096	2
7610	Helpers – Installation, Maintenance, and Repair Workers	49-9098	2
7620	Other Installation, Maintenance, and Repair Workers	49-909X	*nd*

Production and Operating Workers (7700-7750)

Code	Occupational title	SOC equivalent	[a]Job zone
7700	First-Line Supervisors/Managers of Production and Operating Workers	51-1011	3
7720	Electrical, Electronics, and Electromechanical Assemblers	51-2020	2
7740	Structural Metal Fabricators and Fitters	51-2041	3
7750	Miscellaneous Assemblers and Fabricators	51-2090	*nd*

Food Preparation Occupations (7800-7850)

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
7800	Bakers	51-3011	2
7810	Butchers and Other Meat, Poultry, and Fish Processing Workers	51-3020	1
7830	Food and Tobacco Roasting, Baking, and Drying Machine Operators and Tenders	51-3091	2
7840	Food Batchmakers	51-3092	2
7850	Food Cooking Machine Operators and Tenders	51-3093	2

	Setter, Operators, and Tenders (7900-8960)		
7900	Computer Control Programmers and Operators	51-4010	*nd*
7920	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	51-4021	2
7930	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	51-4022	2
7940	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	51-4023	2
7950	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	51-4031	2
8000	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4033	2
8010	Lathe and Turning Machine Tool Setters, Operators and Tenders, Metal and Plastic	51-4034	2
8030	Machinists	51-4041	3
8040	Metal Furnace and Kiln Operators and Tenders	51-4050	2, 3
8060	Model Makers and Patternmakers, Metal and Plastic	51-4060	3
8100	Molders and Molding Machine Setters, Operators, and Tenders, Metal and Plastic	51-4070	2
8120	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4081	2
8130	Tool and Die Makers	51-4111	3
8140	Welding, Soldering, and Brazing Workers	51-4120	2

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
8150	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	51-4191	2
8200	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	51-4193	2
8220	Metalworkers and Plastic Workers, All Other	51-4199	*nd*
8230	Bookbinders and Bindery Workers	51-5010	2
8240	Job Printers	51-5021	3
8250	Prepress Technicians and Workers	51-5022	3
8260	Printing Machine Operators	51-5023	2
8300	Laundry and Dry-Cleaning Workers	51-6011	2
8310	Pressers, Textile, Garment, and Related Materials	51-6021	1
8320	Sewing Machine Operator	51-6031	1
8400	Textile Cutting Machine Setters, Operators, and Tenders	51-6062	2
8410	Textile Knitting and Weaving Machine Setters, Operators, and Tenders	51-6063	2
8420	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	51-6064	2
8440	Fabric and Apparel Patternmakers	51-6092	
8450	Upholsters	51-6093	2
8500	Cabinetmakers and Bench Carpenters	51-7011	3
8510	Furniture Finishers	51-7021	1
8530	Sawing Machine Setters, Operators, and Tenders, Wood	51-7041	2
8540	Woodworking Machine Setters, Operators, and Tenders, Except Sawing	51-7042	2
8630	Miscellaneous Plant and System Operators	51-8090	3
8640	Chemical Processing Machine Setters, Operators, and Tenders	51-9010	2
8650	Crushing, Grinding, Polishing, Mixing, and Blending Workers	51-9020	2

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
8710	Cutting Workers	51-9030	2
8720	Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders	51-9041	2
8740	Inspectors, Testers, Sorters, Samplers, and Weighers	51-9061	2
8750	Jewelers and Precious Stone and Metal Workers	51-9071	2, 3, 4
8760	Medical, Dental, and Ophthalmic Laboratory Technicians	51-9080	2
8800	Packaging and Filling Machine Operators and Tenders	51-9111	2
8810	Painting Workers	51-9120	2
8830	Photographic Process Workers and Processing Machine Operators	51-9130	2
8850	Cementing and Gluing Machine Operators and Tenders	51-9191	2
8920	Molders, Shapers, and Casters, Except Metal and Plastic	51-9195	*nd*
8930	Paper Goods Machine Setters, Operators, and Tenders	51-9196	2
8940	Tire Builders	51-9197	2
8950	Helpers – Production Workers	51-9198	1
8960	Production Workers, All Other	51-9199	*nd*

Transportation and Material Moving Workers (9000-9750)

9000	Supervisors, Transportation and Material Moving Workers	53-1000	3
9040	Air Traffic Controllers and Airfield Operations Specialists	53-2020	3
9110	Ambulance Drivers and Attendants, Except Emergency Medical Technicians	53-3011	2
9120	Bus Drivers	53-3020	2
9130	Driver/Sales Workers and Truck Drivers	53-3030	2
9140	TaxiDrivers and Chauffeurs	53-3041	1
9150	Motor Vehicle Operators, All Other	53-3099	*nd*
9230	Railroad Brake, Signal, and Switch Operators	53-4021	2

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
9240	Railroad Conductors and Yardmasters	53-4031	2
9300	Sailors and Marine Oilers	53-5011	2
9310	Ship and Boat Captains and Operators	53-5020	2, 3
9350	Parking Lot Attendants	53-6021	1
9360	Service Station Attendants	53-6031	1
9510	Crane and Tower Operators	53-7021	3
9520	Dredge, Excavating, and Loading Machine Operators	53-7030	2
9560	Hoist and Winch Operators	53-7041	2
9600	Industrial Truck and Tractor Operators	53-7051	2
9610	Cleaners of Vehicles and Equipment	53-7061	1
9620	Laborers and Freight, Stock, and Material Movers, Hand	53-7062	2
9630	Machine Feeders and Offbearers	53-7063	2
9640	Packers and Packagers, Hand	53-7064	1
9650	Pumping Station Operators	53-7070	2, 3
9720	Refuse and Recyclable Material Collectors	53-7081	2
9740	Tank Car, Truck, and Ship Loaders	53-7121	2
9750	Material Moving Workers, All Other	53-7199	*nd*
	Armed Forces (for CPS)		
9840	Armed Forces		*nd*
	CPS Special Codes		
9970	Problem Referral		
9990	Not Reported (Includes Refused, Classified, Blank and all other noncodable)		*nd*

Table A. (continued).

Code	Occupational title	SOC equivalent	[a]Job zone
	Military Specific Occupations (for ACS)		
9800	Military officer special and tactical operations leaders/managers	55-1010	*nd*
9810	First-line enlisted military supervisor/managers	55-2010	*nd*
9820	Military enlisted tactical operations and air/weapons specialists and crew members	55-3010	*nd*
9830	Military, rank not specified	99-9999	*nd*
	ACS Special Codes		
9950	Not in Labor Force		*nd*
9960	Retired		*nd*
9970	Problem Referral		*nd*
9990	Uncodable (includes Refused or Classified)		*nd*

Source: U.S. Department of Labor. (2007b), U.S. Department of Labor. (n.d.).
Note. [a] For the explanation of job zone, see Table 2. *nd* stands for not definable.

Vita

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Education

- M.S., The Pennsylvania State University, University Park, PA. Workforce Education and Development.
- B.A., Korea University, Seoul, Korea. English Education.

Professional Qualification and Experiences

- Research Assistant, Outreach, The Pennsylvania State University
- Deputy Director, The Seoul Metropolitan Office of Education, Korea
- Deputy Director, The Ministry of Education and Human Resources Development, Korea
- Passed the Higher Civil Service Examination of Korea.

Methodological Training

- Statistics: Sample Selection Modeling, Hierarchical Linear Modeling, Structural Equation Modeling.
- Software: SPSS, MINITAB, STATA, HLM, LISREL.

Scholarly Works under Review

- Kim, Kyung-Nyun & Baker, R. M. (2008). The assumed benefits and hidden costs of adult learners' enrollment in college. Manuscript submitted for publication.
- Kim, Kyung-Nyun. (2009).The effects of maternal traits on the formation of educational expectations of child in lower SES. Manuscript submitted for publication.
- Kim, Kyung-Nyun., Jeon, K. S., Kolb, J. A. & Tenny, K. (2009). The choice of less-formal work-based learning and its economic consequence. Manuscript submitted for publication.
- Kim, Kyung-Nyun & Jeon, K. S. (2009). The occupational advancement of school dropouts. Manuscript submitted for publication.

Awards and Scholarships

- Conrad Frank, Jr. Graduate Fellowship in the College of Education.
- Long-Term Study Abroad Fellowship sponsored by the Korean Government