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Tracking Persons from High School through Adult Life—Lessons from the Wisconsin Longitudinal Study*

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Abstract

The Taiwan Education Panel Survey (TEPS) is a national survey of students in Grade 7 and Grade 11 in 2001. These

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students, born around 1989 and 1985, were followed longitudinally across secondary school years. A new follow-up study has been planned and is about to trace these TEPS students several years after high school graduation, with the purpose of learning about their marital status and experiences in the college and labor markets. For more than 50 years, the Wisconsin Longitudinal Study (WLS) has been studying and following up a random sample of 10,317 Wisconsin high school graduates from 1957. In this paper, we outline WLS experiences which may be helpful for future follow-up studies of TEPS students.

Key Words: WLS, TEPS, longitudinal survey, data collection, life course

I. Introduction

Large-scale longitudinal social surveys that continue over a long time and maintain a high level of sample retention are rare. A successful longitudinal study of the life course must overcome difficulties in tracing a large number of respondents over several decades. Moreover, it should survive long enough to experience evolvments in design and content as the characteristics of the respondents, research opportunities, and social policies change over time. Such a long-term study serves not only as a source of the growth of scientific knowledge, but also a model to be emulated in more recent, ongoing longitudinal social surveys. This paper aims to outline several lessons from a large-scale longitudinal study over the life course of Americans from late adolescence into old age, the Wisconsin Longitudinal Study (WLS).¹ These lessons maybe useful for a young panel study, the Taiwan Education Panel Survey (TEPS).²

After several waves of data collection since 2001, the TEPS has completed its mission as a longitudinal study of youth prior to high school graduation. In the near future, TEPS will enter upon a new phase by undertaking two major projects—(a) to replicate the TEPS for younger cohorts and (b) to follow up randomly selected individuals in two nationally representative samples of high school juniors (Grade 11) in 2001 and 2005.³ If the search for the

¹ WLS data and documentation are available on the world wide web at <http://www.ssc.wisc.edu/wlsresearch/>

² The TEPS is designed and supported by Academia Sinica, National Science Council, Ministry of Education, and National Academy for Educational Research Preparatory Office. The principal investigator is Professor Ly-Yun Chang at the Institute of Sociology, Academia Sinica. TEPS data and documentation are available on the world wide web at <http://www.teps.sinica.edu.tw/>

³ A research team, directed by Professor Kuo-Hsien Su at the National Taiwan University, will replicate the TEPS for younger cohorts. A follow-up study of post-high school experience based on the TEPS will be conducted by a research team, directed by Professor Ping-Yin Kuan at the National Chengchi University in Taiwan.

selected high school juniors is successful, the TEPS will be ready for a study of post-high school experiences and achievements, which parallels the 1964 follow-up study of the WLS in terms of respondent age. As the TEPS plans to follow up on some of its respondents after high school graduation, it is important to learn from the experiences of other longitudinal studies. In this paper, we focus on the experiences of the WLS which is long-lasting and has a complete record of the subjects' ability, aspiration, and achievement. We first review the history and design of the WLS and the TEPS. Then we describe the strengths of the WLS and provide suggestions for future follow-up studies of Taiwanese youth.

II. History and Design of the WLS

The Wisconsin Longitudinal Study (WLS) has a history of more than 50 years and is still ongoing. The next (fifth) WLS follow-up study is scheduled in 2010, when the primary respondents (a random sample of a third of all high school graduates of 1957 in Wisconsin) will be around 71 years old. The WLS originated in a survey of educational plans for the State of Wisconsin that was conducted in 1957. The 1957 survey covered nearly all high school graduating seniors in Wisconsin, consisting of 35,000 seniors in public, private, and parochial schools. A third of these high school graduating seniors were randomly sampled for the WLS, and this sample is referred as "the WLS graduates." Four follow-up studies have been conducted since the baseline survey of 1957 with a response rate close to 90% in every follow-up among living WLS graduates.

In the future, the WLS graduates and their families are likely to be followed up several times, not only because many of them will enjoy longevity, but also because population aging has become an important issue worldwide. The WLS graduates were born mainly in 1939, a few years before the onset of the baby boom generation

in the United States. Before the baby boom generation marches into its retirement age, most of the WLS graduates have already passed through it. Thus, the WLS may foretell problems that will become important when the baby boom generation starts to encounter them (Hauser, 2005: 9-10).

A. The 1957 Educational Survey of All Wisconsin High School Seniors

Although the WLS has lasted for more than a half century, the 1957 survey was carried out to meet an immediate need. The 1957 survey of all high school seniors in Wisconsin was conducted by a professor in the School of Education at the University of Wisconsin, J. Kenneth Little, in cooperation with the Wisconsin State Superintendent of Schools (Little, 1958, 1959). The survey was conducted in response to an increasing demand for higher education in Wisconsin during the late 1950s. The purposes of the survey were to study (a) the number of Wisconsin high school graduates interested in pursuing higher education, (b) the extent to which students with high academic ability were not taking advantage of the state's facilities and programs, and (c) the situations and circumstances which facilitated or hindered the pursuit of higher education.

The 1957 survey questionnaire collected information on educational and vocational plans beyond high school, courses taken in high school, the encouragement received from parents, teachers and peers for educational plans, interest and action in applying for admission to college and for scholarships, opinions about the value of going to college, and background data about the graduates and their parents (Little, 1958). The results of the 1957 survey were used by the State to estimate the demand for higher education and to plan its support and development of postsecondary educational institutions.

Data collected from the 1957 survey were soon no longer used and the questionnaires and punch cards were stored in the

basement of the University of Wisconsin administration building. In 1962, the data collected from the 1957 survey were made available to William H. Sewell, an eminent sociology professor at the University of Wisconsin-Madison. Sewell inspected the survey instruments and found each questionnaire contained the name of each student and the name and address of the student's parents, in addition to a code for the high school attended. Sewell then selected a random, one-third sample of all Wisconsin high school seniors in 1957, consisting of 10,317 men and women, for further study (Sewell & Hauser, 1980).

The discovery of the 1957 survey data was exciting because Sewell had long been interested in the formation of youthful aspiration, and how youthful aspiration, in turn, affects educational and occupational choices. The 1957 survey is based on a well-defined population and is essentially a survey of youthful aspiration and educational plans. Data from the 1957 survey provided Sewell with an unusual opportunity to investigate the formation of youthful aspirations.

To study the development of youthful aspirations, however, additional data were needed. Sewell acquired information on the measured mental ability of each student from the files of the Wisconsin State Testing Service, which routinely and almost universally assessed the performance of Wisconsin secondary school students on the Henmon-Nelson Test of Mental Ability from 1933 to the early 1970s (Froehlich, 1941; Henmon & Holt, 1931). In addition, Sewell developed a few indexes based on the data collected from the 1957 survey. These indexes included the socioeconomic status of the student's family, the student's attitudes toward higher education, educational and occupational plans, and perceived influence of significant others on educational plans. To measure school, neighborhood, and community contexts, Sewell used secondary sources and constructed the socioeconomic composition of each senior class, the percentage of its members who planned on going to college, the size of the school, the size and degree of urbanization of the community of residence, and the

distance of the student's place of residence from the nearest public or private college or university (Sewell & Hauser, 1980).

In the first few years after all these measures were made available for research, Sewell and his colleagues investigated the influence of community and neighborhood background on educational aspirations of youth. Sewell and his colleagues found that community, neighborhood, and school contextual effects on educational aspirations and achievements are rather small, once family background, ability, and gender of students are taken into account (Hauser, Sewell, & Alwin, 1976; Sewell, 1963, 1964; Sewell & Armer, 1966; Sewell & Orenstein, 1965). However, some sociologists were reluctant to accept these findings because they believed that a social system, such as a neighborhood or a school, can have a large, independent impact on social inequality (Sewell, Hauser, R. M., Springer, & Hauser, T. S., 2003: 15).

Sewell and his colleagues thought that if a theoretical and empirical model could explain variation in the level of educational aspiration among students, it also could be capable of explaining individual differences in educational attainment. The focus of their research then turned to the contribution of social psychological factors to the development and maintenance of youthful aspirations. The hypothesis was that differences in aspirations between children from families of higher and lower socioeconomic status were, in part, due to differences in the social psychological experiences of children from various socioeconomic status groups. This hypothesis was tested and supported by a path analysis conducted by Sewell and Shah (1968). The effect of socioeconomic status on parental encouragement was found to be larger than that of ability, and the direct effect of parental encouragement on the college plans was found to be greater than the direct effect of socioeconomic status or of ability. The model, however, left much of the variance in college plans unexplained.

B. The 1964 Postcard Survey of Parents

The research on educational aspirations, as briefly introduced above, was mainly based on data from the 1957 survey. As the WLS research progressed, it was natural to pose the question whether or not the WLS graduates eventually realized their educational and occupational aspirations after graduating from high school. Thus, one important goal of the WLS became studies of the actual process of educational, occupational and economic attainments, not just the formation of aspirations.

In 1964, seven years after the students had graduated from high school, Sewell conducted a follow-up study based on the random sample of 10,317 men and women in order to extend the WLS research from the formation of educational aspirations to the process of educational and occupational attainment. Sewell reasoned that parents would be easier to find than youngsters in their mid-20s, so he decided to follow up the parents, rather than the graduates. The survey instrument was a postcard on which the parent was asked to provide information about his or her child with respect to a brief history of educational attainment, current occupation, husband's occupation (for female graduates), son's military service, marital status, the mailing address of the child, and the name of the married daughter (Sewell & Shah, 1967).

The 1964 follow-up study looks extremely simple in its appearance, being composed of a postcard questionnaire that can be filled out in only a few minutes. However, a lot of information about the parents and the graduates was collected from other sources. For example, information on the parents' occupations and income was obtained from their 1957 to 1960 state income tax returns, and information on earnings for the male graduates was acquired from the Social Security Administration for each year of covered employment from 1957 to 1967 (Sewell & Hauser, 1980). As opportunities arose, the earnings record was extended to cover the period from 1957 to 1971, and the WLS data were further enriched by published sources of information on the characteristics

of the primary, secondary and post-secondary schools, colleges, and universities attended by the graduates (Hauser, 2009; Sewell et al., 2003).

With additional data from the 1964 follow-up study, Sewell and his colleagues examined the role of social psychological variables in mediating the influence of status origins on educational and occupational attainments. These analyses eventually led to the well-known “Wisconsin Social Psychological Model of Status Attainment” (Sewell, Haller, & Ohlendorf, 1970; Sewell, Haller, & Portes, 1969; Sewell & Hauser, 1975). WLS research and findings became highly visible and have been cited thousands of times by social scientists around the world. The accomplishment of the WLS research at this stage built heavily on the success of the 1964 follow-up study and the 1957 survey of all Wisconsin high school seniors. With a response rate of 87.1%—after five waves of mailing and a telephone follow-up—the 1964 survey set the standard for later WLS follow-up studies (and for subsequent longitudinal studies in the U.S.).

C. The 1975 Telephone Survey of Graduates and the 1977 Telephone Survey of Siblings

Robert M. Hauser joined the WLS project in 1969 and has directed the WLS since 1980 (Hauser, 2005: 5). In the early 1970s, Sewell and Hauser decided to conduct another follow-up study because high school seniors who had graduated in 1957 were in their mid-30s and had moved to a different stage in their careers and family lives; most men were likely to have stable jobs and most women were done with caring for young children. This time the graduates would be directly contacted, 18 years after high school graduation. It was a challenge to trace all 10,317 graduates nearly two decades after high school graduation and to administer a one-hour telephone interview with each graduate after successfully locating them. In the end, 92.7% of the surviving members of the original sample were interviewed by telephone (Clarridge, Sheehy,

& Hauser, 1977; Hauser, 2005: 15).

The 1975 telephone survey collected data on post-secondary education, current and past occupations, earnings in the past year, work satisfaction, future occupational plans, marital status, number of children, characteristics of present family, spouse's occupation and education, and participation in elections and community organizations (Sewell & Hauser, 1977). The data collected in 1975 allowed the Wisconsin Model to be modified and elaborated in several important ways: (a) The model was extended to include earnings as an dependent variable (Sewell & Hauser, 1975), (b) occupational status attainment processes of women were compared with those of men, and (c) occupational status was based on first job as well as the job held at age 36 (Sewell, Hauser, & Wolf, 1980). In other words, with additional data collected in 1975, the WLS research team was able to examine more completely the status attainment processes of men and women up to age 36.

In 1975, 92% of the WLS graduates had at least one living sibling, and 71% had at least two. For every WLS graduate with siblings, the 1975 survey obtained a list of living siblings, which included age, sex, and highest level of schooling (Sewell & Hauser, 1980: 92). In each sibling list, one (focal) sibling was selected at random for further research. The WLS team then located adolescent cognitive ability test scores for 6,619 focal siblings of graduates from the Wisconsin State Testing Service, and these tested siblings accounted for 75% of all selected siblings. In 1977, a telephone interview similar to that given the graduates was administered to 2,100 of all randomly selected siblings. This made it possible to study the resemblance of siblings in cognitive ability and socioeconomic attainment.

D. The 1993 Telephone/Mail Survey of Graduates and the 1994 Telephone/Mail Survey of Siblings

In 1993, when graduates were age 54, telephone and mail surveys were conducted to update measurements of marital status,

child-rearing, education, labor force participation, jobs and occupations, social participation, and future aspirations and plans (Hauser et al., 1994). In addition, new measurements were added. These included psychological well-being, mental and physical health, wealth, household economic transfers, and social and exchange relationships with parents, siblings, and children.

The sibling sample was expanded in this wave of data collection. Approximately 2,800 more siblings were interviewed in this round of study. The sibling surveys (telephone and mail) were conducted in 1994 and covered nearly the same content as that of the graduates. The telephone interview lasted about one hour, followed by a mail survey which contained questionnaires of 20 to 24 pages. Out of 9,741 survivors, eventually 8,493 WLS graduates were interviewed by telephone (87.2%) (Hauser, 2005: 17-18). For the WLS graduates who completed the telephone interviews, the response rate of the mail survey was 80.9%. For siblings, the telephone response rate was 76.7% out of 6,261 focal siblings who were to be interviewed, and the mail response rate among telephone completers was 72.9%. Because some siblings received only the mail questionnaire, a total of 4,062 mail surveys were completed.

Data collected from the 1993-1994 surveys made possible a longitudinal investigation of occupational careers up to age 54 and thus extended the Wisconsin Model of occupational achievement across a longer time span (Hauser, Warren, Huang, & Carter, 2000). In addition to an extension of the Wisconsin model, data collected by the 1993-1994 follow-up study facilitated (a) multidisciplinary research by including detailed measures of mental and physical health, (b) an investigation into "local effects" which may increase our knowledge about why individuals differ in occupational outcomes, (c) analyses of sibling resemblances that illuminate the influences of the family of origin on life course, and (d) research into social and economic exchange relationships with parents, children, and siblings, and how these relationships may have consequences for well-being (Hauser et al., 1992). The

1993-1994 follow-up study marked a transition in research focus from a study of education, careers and family to include health and aging.

E. The 2003-2006 Telephone and Mail Surveys of Graduates, Siblings, Spouses, and Widows

The process of aging involves biological, demographic, social, and economic changes. To investigate the process of aging, therefore, requires interdisciplinary efforts. In the follow-up study of 2003-2006, the WLS has evolved into a multidisciplinary study of aging and the life course, including more than 50 investigators and research colleagues at the University of Wisconsin-Madison and other universities in the United States (Hauser & Roan, 2006). These WLS research scientists specialize in various scientific fields, including sociology, demography, epidemiology, economics, social and cognitive psychology, industrial engineering, neuroscience, social work, psychiatry, nursing, and medicine. Data collection no longer depended entirely on telephone and mail surveys. The instruments of data collection were extended to include brain imaging and a small number of personal interviews, in addition to linking records of individuals, organizations, and local districts. The follow-up study started in the summer of 2003, when the WLS graduates were 63 and 64 years old, and their brothers, sisters, and spouses were generally between the ages of 55 to 73. In the 2003-2006 study, the WLS sample was also expanded to include the spouses or widows of graduates as well as their siblings and spouses of siblings. DNA samples were collected from the WLS graduates in 2007 and their siblings in 2008.

The research agenda was broadened to include social and economic factors in health and aging, and the study asked questions about family life, health, work and retirement, experiences with doctors and the health care system, and finances (for details, see Hauser & Roan, 2006). The research questions proposed by the WLS in the 2003-2006 study included the use of

medical care, quality of life among the near elderly, cumulative effects of job characteristics and working conditions on health and cognitive functioning, effects of life trajectories on brain structure and activation, preparation for death among the near elderly, the impact of disability and death of children on parents' lives, and factors associated with the transition to retirement.

III. History and Design of the TEPS

In terms of survey content and design, the TEPS resembles the National Education Longitudinal Study of 1988 (NELS) in the United States. Data collected from TEPS, like those collected from the NELS, can be used for policy-relevant research about educational processes and outcomes. However, unlike the NELS, which followed a single cohort (eighth-graders in 1988), the TEPS followed two nationally representative samples: seventh-graders and eleventh-graders who were first surveyed in 2001 (Chang, 2002). Grade 7 is equivalent to the first year of lower secondary schooling, and the students are about 13 years old. Grade 11 is one grade below the highest grade level in Taiwanese secondary schooling, and most eleventh-graders are 17 years old.

A. The First Wave of Data Collection, 2001

Taiwanese high schools run on a two-semester arrangement, with fall and spring semesters in an academic year. An academic year begins with the start of autumn and ends the following summer. The first (fall) semester starts from September to January and the second (spring) semester runs from February until June. The TEPS baseline survey was carried out in late 2001 when students in Grades 7 and 11 were in the first semester. The baseline survey collected data from students, parents, teachers, and schools. Furthermore, a cognitive test was administered to all students, not only in the baseline survey, but also in every later wave of data collection.

The TEPS adopted a three-stage stratified cluster sample design, with schools as the first stage, classes as the second stage, and individual students as the third stage. For each grade level, the TEPS sample is nationally representative of the Taiwanese student population (Chang, 2009). Within each sampled school of a given grade level, three to six classes were randomly sampled. Within each sampled class, 15 or more students were randomly sampled for research. In the baseline survey of Grade 7, a total of 20,055 students were sampled for research, and these students were from 1,244 sampled classes across 333 sampled schools. In Grade 11, the baseline survey sampled 19,051 students who were in 1,040 sampled classes of 286 sampled schools.

(A) Student questionnaire

The student questionnaire was administered to students in the classroom. It collected information on (a) student daily schedule and activities, including sleeping time, when to come and leave school, the amount of time spent on homework and test preparation, after-school private tutoring participation, absenteeism and tardiness arrival, summer activities, and the most time- and effort-demanding academic subject; (b) family life, including living arrangements after school, family members at home, sibship size, birth order, sibling sex composition, unfortunate events that occurred in the family, family assistance in completing homework, parental attention to educational and career plans of the student, conflicts with parents and siblings, and daily amount of time staying at home without the presence of an adult; (c) school life, including the student's evaluation of whether the school is a friendly place for learning, the prevalence of deviant behavior in school, teacher behaviors, whether the student thinks that he or she is a popular figure in school, and how often the student in school has had personal belongings stolen in school, been sexually harassed, been solicited to buy illegal drugs, and been threatened; (d) participation in extracurricular activities, including participation in essay, speech, and science contests, membership in marching

band, choir, and sports teams, involvement in various clubs within the school, serving as staff in student organizations, total amount of time spent on school-related extracurricular activities, extracurricular participation outside school, ways to spend allowance, the number and the gender of friends you often hang out with, acquaintanceship with the parents of his or her close friends, the frequency of visiting homes of his or her close friends, whether close friends like to read, are versatile, with whom you can have heart-to-heart talks, misbehave in school, or drink, smoke, or chew betel nuts; (e) measures of physical and psychological well-being; (f) highest level of schooling expected; and (g) miscellaneous items such as birth year, gender, languages spoken fluently, experience of being in a class for gifted students, and how often the family has moved to a different residential area. The last page of the student questionnaire ascertains (a) the names of the student, the class, and the school; (b) height, weight, and degrees of nearsightedness, farsightedness, and astigmatism; and (c) the addresses and phone numbers of parent's home, a friend's home, and a relative's home. These addresses and phone numbers are necessary for tracing sampled students after they leave their school.

The content of the student questionnaire between Grade 7 and Grade 11 does not differ. The questionnaire for Grade 11, however, asked additional questions on high school enrollment and persons who were influential in decisions about track position and course-taking.

(B) Parent questionnaire

The student was asked to bring the parent questionnaire home, and after it was completed by a parent, the student was then asked to bring it back to the school to be collected by the TEPS interviewer. For students who attended boarding schools, the parent questionnaire was mailed to the parents' home. After completing the questionnaire, parents were asked to return post it to the TEPS interviewer. In order to promote response rates, students were entitled to draw lots for a prize when the student

and parent questionnaires were successfully completed. The prizes included a variety of goods, such as backpacks and CD holders, and large prizes such as bicycles.

The parent was asked to provide information about (a) personal and family background, such as his or her relation to the student, birth year, gender, marital status, educational attainment, occupation, ethnicity, level of proficiency in six different languages (Mandarin, Taiwanese, Hakka, Aboriginal languages, English, and Japanese), disability, family income, number of wage earners in the family, whether there are disabled persons in the family requiring care, access to the internet, availability of magazines, books, and encyclopedia at home, and the amount of time being together with the student daily; (b) characteristics of his or her spouse, including the spouse's educational attainment, occupation, birth year, ethnicity, amount of time spent with children daily, proficiency in the six different languages, and disability status; (c) parental knowledge about the student's learning behavior, health status, deviant behavior, and relationships with peers; (d) his or her relation with the student's friends, such as whether the parent knows the names of the student's three best friends and how often the parent meets with student's friends; (e) the purposes and the frequency of contact between the parent and the school; (f) family activities, including concert and opera attendance, going to bookstores, and participation in voluntary service; (g) family conflicts, e.g., whether either parent has conflicts with the student and how they deal with the conflicts, how often the student's behavior causes conflicts between the two parents; (h) expectation about the student, such as the highest educational degree expected and whether the parent expected the child to go abroad for further study; (i) family support for the education of the student, indicated by whether the parent has savings for student's further education, whether the parent has moved to a different neighborhood so the student may go to a better school, whether the parent has made an effort to choose a better class for the student, whether the parent has given gifts to the student's teachers, and family expenditure on

private tutoring in academic and nonacademic subjects. Between Grade 7 and Grade 11, the content of the parental questionnaire does not differ.

(C) Teacher questionnaire

For each sampled student, four teachers were asked to fill in teacher questionnaires: Math, English, and Chinese teachers, in addition to the class advisor. Each teacher responded to questions regarding (a) the teacher him/herself, (b) the class of the sampled student, and (c) the sampled student. The structure and the content of the teacher questionnaires are the same between Grade 7 and Grade 11.

With respect to the teacher him/herself, the teacher questionnaire seeks information on teaching experience, teaching and administrative work load, daily and weekly schedule of teaching and communicating with parents, teaching beyond regular school days and hours, teaching certificates and qualifications, the highest level of schooling completed, attendance at on-the-job professional training, degree of autonomy in teaching, teamwork teaching, organizational support in teaching, overall evaluation of student learning atmosphere in school, the use of innovative teaching methods, attitude toward school administrative policies, job satisfaction, and some background information such as gender, age, marital status, number of children, number of children under age six, self-evaluation of health status, and number of disabled family members at home.

With respect to the class of the sampled student, the class advisor answered different questions from those answered by the Math, English, or Chinese teachers. The class advisor responded to questions concerning academic performance and behavior problems of the class, parental involvement, parent-teacher interaction, and disciplinary policies. The Math, English, and Chinese teachers answered questions with respect to the match between their fields of specialization and courses taught, academic performance of the class, policy on within-classroom ability

grouping, teaching methods, the use of teaching materials and tools, number of homework assignments and tests given to students per week, and criteria used in grading students.

As to the sampled student, the class advisor evaluated the student's mental maturity, skills in using computers, clarity in oral presentation, leadership, organization, problem solving ability, learning motivation, and ability to write a report independently, to complete a project with peers, and to think logically. The class advisor was also asked to report the student's disciplinary problems and deviant behaviors. The Math, English, and Chinese teachers were asked to assess the student's learning status, such as the extent to which the student is (a) able to keep up with the pace of instruction, (b) hard working, (c) prompt in submitting homework assignment, and (d) willing to raise questions in class.

(D) School questionnaire

The school questionnaire was completed by several staff members: the school principal and heads of different administrative offices within school. The school questionnaire aims to collect information on organizational factors affecting student learning opportunities, including school policies, leadership characteristics, school principal's vision, school resources, teacher quality, school finances and expenditures. The school questionnaire was administered to school administrative staff in the first and the fourth waves of data collection, but not in the second or the third.

(E) Cognitive test

The cognitive test was designed to measure student learning growth across the secondary schooling years (Yang, Tam, & Huang, 2003). The test aims more to measure the ability to learn and less to measure the accumulation of factual knowledge. The test includes two components: (a) a subject-specific component, which assesses students' math, science, and verbal achievements; and (b) a curriculum-free component, which assesses students' analytical, practical, and creative abilities. The subject-specific component

includes 20 test items in math, 10 to 12 items in science, and 14 to 16 items in vocabulary knowledge (Chinese and English), with a total number of 44 items in Grade 7 and 48 items for Grade 11. The curriculum-free component includes three 9-item subtests, measuring analytical, practical, and creative abilities. Within each ability domain, there are three verbal, three graphical, and three numerical test items.

Seventh-graders had 88 minutes to complete the whole test of 71 items. Eleventh-graders were given 94 minutes to complete 75 test items. Both raw and IRT (item response theory) scores were made available for research (Yang et al., 2003).

B. The Second Wave of Data Collection, 2003

By February of 2003, the Grade 11 sample had moved on to the last (spring) semester of high school and was expected to graduate in June. This was the semester when the Grade 11 sample was followed up. By September of 2003, in the fall semester, students in the Grade 7 sample had newly become ninth-graders, and this was when their follow-up survey was conducted.

As in the baseline survey, the student questionnaires in the 2003 follow-up study also ascertained information on student daily schedules and activities, but there was an extended inquiry on the use of out-of-school private tutoring. In some parts of Asia, particularly in Taiwan, parents invest heavily in private tutoring to enhance the academic achievement of their children in primary and secondary schools (Zeng, 1999). Private tutoring is the use of outside-school instruction, provided by profit-oriented individuals or school-like organizations, to raise the performance in key academic subjects in school, such as math and science. The prevalence of private tutoring in some East Asian countries has been regarded as a distinctive educational phenomenon; it is related to the Confucian cultural heritage and facilitated by tremendous competition for entrance into elite high schools and universities (Bray & Kwok, 2003).

In the 2003 follow-up survey, students were also asked to report on the parenting behavior of their parents, teaching styles of their teachers, highest educational degree expected, opinions on a few value-related questions, learning behavior, conditions of psychological well-being, and some background information, such as gender, religion, eyesight, and living arrangement. Between grade levels, the student questionnaires covered the same content. In Grade 11, however, students answered fewer questions on the use of after-school private tutoring, but they answered additional questions on the occupation they desired to have, educational qualification required for entering the occupation, and expected earnings associated with the occupation.

The parents were followed up as well, but the parent who filled in the parent questionnaire in 2003 was not necessarily the same person who completed the parent questionnaire in the 2001 baseline survey. In the 2003 follow-up survey, the parents were asked to answer some new questions as well as several questions carried over from the 2001 baseline survey. The new questions asked parents to provide information about their religion, participation in religious, art-related, and volunteering activities, father's education, parenting principles and behaviors, and personal values. In addition, in the 2003 follow-up survey, parental questions specific to the spouse were asked to be answered by the spouse him/herself. The content of the parental questionnaire does not differ by grade levels.

For every student followed up, again, four teachers were asked to fill in teacher questionnaires: Math, English, and Chinese teachers, as well as the advisor of the class. These teachers in the 2003 survey may not have been the same persons who filled in the teacher questionnaires in the 2001 baseline survey. Again, each teacher responded to questions regarding (a) the teacher him/herself, (b) the class of the sampled student, and (c) the sampled student. In the 2003 follow-up survey, several new questions were added to the teacher questionnaires, while some questions that had appeared in the baseline survey were dropped.

For example, questions related to organizational support in teaching and attitude toward school administrative policies were asked in the 2001 baseline survey, but not in the 2003 follow-up survey. Religion, religious activities, father's ethnicity, and a set of questions measuring personal values were in the 2003 follow-up survey but not in the baseline survey.

Between the baseline survey of 2001 and the follow-up survey of 2003, most students sampled by TEPS stayed in the same school or even in the same classroom. Thus, response rates were extremely high in the follow-up survey of 2003. In the Grade 7 sample, responses were obtained for 95% of the original sample in the baseline survey. In the Grade 11 sample, it was 96%.

C. The Third Wave of Data Collection, 2005

The sample of students in Grade 11 were first surveyed in 2001 and then followed up in 2003 when they were about to graduate from high school. After 2003, the sample was no longer studied because the TEPS aimed to study student life longitudinally up to high school graduation. Therefore, the third wave of data collection contained only one cohort, a nationally representative sample of 20,136 eleventh-graders in 2005. Some of these eleventh graders, about 4,000 students, were from the Grade 7 sample of the baseline survey in 2001. These 4,000 students, called the "Core Panel," have been observed by the TEPS for three times, in 2001, 2003, and 2005.⁴ All other students who are not in the Core Panel are called the "New Panel." Students in the New and the Core Panels, altogether, constituted a nationally representative sample of

⁴ The Core Sample constitutes a total of 4,262 students. Among them, 4,100 students completed the student questionnaire, 4,024 students had their parents completed the parent questionnaire, and 4,178 students took the cognitive test. Two years later, in the fourth wave of data collection conducted in 2007, a total of 3,992 students in the Core Sample successfully completed the student questionnaire, and the number is 3,956 for the parent questionnaire, and 4,042 for the cognitive test.

eleventh-graders as of 2005 (Tam, 2004). Therefore, this gives three nationally representative samples in the TEPS: (a) the Grade 7 sample of 2001, (b) the Grade 11 sample of 2001, and (c) the Grade 11 sample of 2005. The Grade 7 sample of 2001 and the Grade 11 sample of 2005 are two independent national samples of students born in the same year (around 1989).

The content of the questionnaires was similar to that in the first and second waves of data collection. In the third wave of data collection, however, students were asked to report their test scores in the “Basic Competence Test for Junior High School Students.” This test is administered to most Taiwanese ninth-graders for admission to senior high schools. Taiwanese students compete ferociously for places in the best public academic high schools based on the results of the test. Taiwanese students who score low in the test usually end up going to private vocational high schools that are not geared toward 4-year academic universities. Indeed, many Taiwanese students who end up going to private vocational high schools end their formal educational experience there and do not pursue higher education.

D. The Fourth Wave of Data Collection, 2007

By early 2007, when the New and the Core Panels reached Grade 12 and were about to graduate, a follow-up study was conducted. Because nearly all students stayed in the same school/classroom between surveys, responses were obtained for 97% of the original sample (20,136 eleventh-graders in 2005). Students in the Core Panel have been surveyed individually for four times, in 2001, 2003, 2005 and 2007, when they were in Grades 7, 9, 11 and 12, respectively. Other than the Core Panel, students sampled by TEPS were surveyed individually twice either between (a) 2001 and 2003 or between (b) 2005 and 2007. The fourth wave of data collection marked the end of the TEPS Survey which has investigated two student cohorts (seventh- and eleventh-graders in 2001) up to high school graduation.

IV. Strengths and Limitations of the WLS

The WLS data are selective in some respects, and therefore they are not without limitations. All the WLS graduates completed high school; their siblings and spouses, however, vary more in educational attainment. The number of African Americans, Hispanic, or Asian persons in the WLS is not large enough to allow for a between-race comparison. In addition, the WLS graduates are homogeneous in age, and it is not possible to have a between-cohort comparison. However, the ages of selected siblings vary widely. Most of the siblings are within the range of 10 years older to 10 years younger than the graduates. Finally, the WLS data are representative of all Wisconsin high school graduates in 1957, but they are not nationally representative. Nevertheless, when Jencks, Crouse, and Mueser evaluated the WLS for studies of status attainment, they suggested: "If the determinants of status attainment really vary appreciably from state to state, we should not be pooling data from different states into national samples. If the processes do not vary appreciably, we can learn as much from Wisconsin as from the whole country" (1983: 4).

The strengths of the WLS provide lessons, not only for the future follow-up projects of TEPS students, but also for many other longitudinal studies in general. In the following, we list several strengths of the WLS.

A. Sustaining a High Response Rate over a Long Time

Attrition, especially non-random attrition, is a major concern in any longitudinal study. The WLS has been successful partly because it has maintained a high response rate over a long period in every wave of data collection. In this section, we address two questions: (a) How did the WLS maintain a high response rate in every wave of data collection? (b) How did the WLS tackle and

examine the problem of non-random attrition?

(A) Response rate of the 1964 follow-up: 87.1%

The development of the famous Wisconsin Status Attainment Model is attributable to the success of the 1964 follow-up study which had a response rate of 87.7% for men and 86.5% for women, with an overall response rate of 87.1%. This success was related to several factors:

First, data from the 1957 baseline survey provided information on the name of each graduate and the name and address of the graduate's parents, in addition to a code for the high school attended. Without this name and address information, a follow-up study might not be possible.

Second, the questionnaires were mailed to the parents, not the graduates. Youngsters in their mid-20s are geographically more scattered than their parents, who are more likely to stay in the same addresses. Moreover, youth are less likely to be willing to share information about themselves, while parents like to talk about their children.

Third, the 1964 study managed to have a very short questionnaire which (a) could be mailed in a postage-paid double postcard, (b) contained only six questions, (c) could be filled out in only a few minutes, and (d) could be mailed back to the sender conveniently. Respondents were more likely to cooperate because the survey took little time and effort. To encourage participation from respondents who were not yet familiar with the survey, it made sense for the first follow-up survey to be concise. While the questionnaire was short, it contained necessary and important questions.

Fourth, Sewell and his associates realized that interviewing the graduates would not be the only way to get information. The effective use of public or administrative record data contributed to the success of the 1964 follow-up study. Information on measured cognitive ability, high school rank, earnings of male graduates, and parental occupation and income was made available from school

and public records with proper safeguards to protect individual identity. The 1964 follow-up survey only required a very short questionnaire because of (a) the supplemental information from public records provided information for nearly every respondent, (b) the project had a focused research agenda on status attainment processes, and (c) there was rich information on social background, high school curriculum, youthful aspiration, educational plans, and social influences from the 1957 baseline survey.

Fifth, a high response rate was achieved after four waves of mailing and a round of telephone interviews (Pavalko & Lutterman, 1973; Sewell & Shah, 1967). Sewell and his associates were persistent in searching for every parent and asking for responses. When parents did not respond to the mail survey for the first time, they were mailed a second double postcard questionnaire with a stamp of "Urgent Second Request." Those who did not respond to the second mailing, they were sent a third questionnaire marking "Urgent Third Request." Non-respondents to the third request were written a personal letter urging their participation. In the letter, a copy of the postage-paid questionnaire was attached. Those who did not respond to the letter were interviewed by telephone whenever possible. For those who lacked valid addresses, up-to-date addresses were obtained from Wisconsin tax rolls. When addresses were updated for these non-respondents, they were mailed the questionnaire up to four times, and whenever necessary, interviewed by telephone (see also Pavalko and Lutterman [1973] for the response rate of each wave of mailing and calling).

Using data from the 1964 follow-up study, Pavalko and Lutterman addressed the issue of non-random attrition and investigated the characteristics of willing and reluctant respondents in each wave of response requests (1973). Pavalko and Lutterman found that:

It is evident that there exists a selective early response pattern which produces a definite and consistent bias. Had

we been content to limit the 1964 survey to one or even two waves, there would have been a serious underrepresentation of persons who are low on variables such as measured intelligence, high school rank, educational plans, educational and occupational attainment, and an over-representation of persons classified high on these variables. Consequently, it is clear that successive mailing waves do more than merely increase the overall response rate. Much more important is the fact that additional mailing waves minimize and can eventually eliminate the selective nature of early response. Thus, four mailing waves result in a more nearly equal proportion of respondents at different levels on these variables. (Pavalko & Lutterman, 1973: 470)

Sewell and Hauser also investigated the data collected from the 1964 follow-up survey and found little systematic non-response. Therefore, findings suggested that Sewell's persistent and repeated efforts to obtain response from reluctant respondents were well-rewarded. Such efforts not only raised the response rate, but also tackled the problem of non-random attrition (1975).

(B) Response rate of the 1975 follow-up: 92.7%

The 1975 follow-up study faced an even greater challenge—to contact and interview 10,317 Wisconsin high school graduates of 1957 for the first time, 17 years after high school graduation. A tracing operation conducted in 1975 located 99% of the persons who responded to the 1964 survey and 86.2% of the persons who did not respond to the 1964 survey (Clarridge et al., 1977). Only 288 graduates were not located out of a total of 10,317 graduates. Eventually, 92.7% of the surviving members of the original sample were interviewed by telephone (Hauser, 2005: 15). This is higher than the 87.3% response rate in 1964. For the sibling survey of 1977, the response rate was as high as 87.8%; this rate, however, is conditional on participation of the graduate in the 1975 survey.

What characterized the successful tracing operation conducted in 1975? Clarridge, Sheehy, and Hauser (1977) and Hauser (2005)

have addressed this question. Here we summarize several factors which may account for the success.

First, the 1964 postcard survey obtained parents' and students' addresses in 1964. These addresses were proven to be very helpful. Over 90% of the 1975 sample was traced through these addresses. Therefore, it is very important to establish anchor points at each panel of a longitudinal study. The 1975 telephone interview also acquired information that allows for tracing individuals in the future. These included current addresses of graduates and their parents; the name and address of respondent's current and last employer; and names and addresses of colleges the respondent attended; the first name, age, and gender of each child; the first name, age, and gender of each sibling; and the full name and address of a randomly selected sibling of the graduate.

Second, the tracing operation of 1975 was characterized by extensive use of the telephone. A telephone interview was possible because the University of Wisconsin-Madison provided long-distance telephone service which was very inexpensive. Studies have suggested that telephone contacts yielded a higher response rate than mail contacts, at least in the 1970s (Alwin & Jensen, 1976).

Third, respondents were located through their parents, so when respondents were initially contacted, it was at the time of interview. This practice was helpful because parents were geographically less scattered than the graduates. In addition, the procedure minimized the number of direct contacts with respondents, therefore reducing the chance for refusal. Respondents were directly traced only when the parent refused to give or did not know the child's address and phone number.

Fourth, before the large-scale tracing operation started, a small sample of 216 cases from the original sample was traced. The sample of 216 cases was stratified by factors related to tracing difficulty, including sex, educational levels (high school graduate, some college, or college graduate), rural or urban residence in 1957, and state of residence in 1964 (Wisconsin or elsewhere).

This classification gave a total of 24 cells, with 9 randomly selected persons in each cell. Eventually, all 216 persons were found. This pilot tracing study (a) tested the feasibility of the search, (b) developed methods for the tracing operation, (c) identified potential problems early, and (d) provided clues about the organization of the tracing process. When this pilot tracing study was completed, the WLS researchers knew that successful tracing was possible, even up to 18 years after high school graduation.

Fifth, given limited funds available for the search, the tracing operation was organized to be able to end at any stage and yet has a representative subsample of the original sample of 10,317 graduates. The sample of 10,317 graduates was stratified into 32 strata according to mental ability, socioeconomic status, and gender. Within each stratum, the sample was divided into numbered tenths. A combination of like-numbered tenths from the 32 strata formed ten equal-sized groups. Tracing these groups one at a time (a) prevented the accumulation of difficult cases at the end of the field period and evened out the workload, (b) provided timely feedback about troubles and achievement in the field operation, (c) allowed for an early estimation of final response rate and costs, and (d) permitted early corrective action before running out of time and resources. This procedure was found to be very helpful, and it has been used in each successive wave of the study through 2003-2006.

Sixth, the tracing operation benefited from persistent searching, which exhausted all sources of information when searching for a potential respondent. Difficult cases were those in which students could not be located directly or through their parents, and had to be located through a variety of means, such as neighbors, alumni groups, employers, the post office, high schools, and military service. In addition, a special letter stressing the legitimacy of the study was mailed to those who were too cautious to participate. Suspicious respondents were invited to place a direct call to one of the study directors. The tracing operation kept detailed records of each contact for each case, and when all tracing attempts failed, a

case was started over all again. Clarridge, Sheehy and Hauser suggested that the process of tracing was unreliable, and a complete recycling of failed cases often led to success (1977).

Finally, the organization and management of the search was considered important in tracing success. As Clarridge, Sheehy and Hauser stated: "The supervisors met frequently to discuss the progress of the tracing operation and refine procedures. Efficient systems of filing and record keeping, as well as clear rules of the flow of work, were essential for dealing with a large number of cases and many employees. Poor organization can lead to great confusion, waste of time and money, and, most important of all, tracing failure" (1977: 190). They also cautioned that tracing failure is due to the fact that "the search is often left to those who have no vested interest in the research or the quality of data" (1977: 186).

According to Clarridge et al., the success of a tracing operation has more to do with the features of the search than the characteristics of respondents (1977). In addition to persistent searching and callbacks, Hauser attributed the tracing success to (a) the moderately high social standing of the WLS respondents and (b) the reputation of the University of Wisconsin among respondents (2005).

With respect to the problem of non-random attrition in the 1975 survey, Hauser found the impact of the problem to be small (2005). There was, however, a sharp drop in response in the bottom tenth of the IQ distribution for men. For example, the response rate was 85.3% in the bottom tenth of the IQ distribution, but it was close to 92% or 93% for others. For women, the drop in response at the bottom was not as sharp, but response rate was generally lower for the bottom 20% of the IQ distribution.

(C) Response rate of the 1993 follow-up: 87.2%

Tracing was also highly successful in 1993, with only 316 graduates not located. The tracing started with a telephone call to either the graduate or the focal sibling, using either as an informant.

When neither could be located, a telephone call was directed to their parents. When all these attempts failed, neighbors and high school classmates were used as information sources (Hauser, 2005).

Respondents were interviewed for an hour by telephone. Those who completed the telephone interview were mailed a questionnaire which was 20 to 24 pages long. Out of 9,741 survivors, 8,493 graduates completed the telephone interview, and this gave a response rate of 87.2%. However, not all who completed the telephone survey responded to the mail survey. After three waves of mailings and a reminder postcard, 6,875 graduates completed the mail survey. This gave a response rate of 80.9% out of all who have completed the telephone survey, and 70.6% of all surviving graduates. For siblings, the telephone response rate was 76.7%, and the mail response rate was 72.9% among those who completed the telephone interview.

Non-random attrition was more of a problem in the 1993 survey than that in previous surveys (Hauser, 2005). Test scores, rank in high school class, and civic participation affected telephone survey response, and accounted for why women and those with higher levels of education had higher response rates. Given the completion of the telephone survey, those who had an IQ score in the lowest 10% were less likely to respond to the mail survey. This indicates that a lengthy mail survey is more cognitively demanding than a telephone interview. Because of the extent of non-random attrition in the 1993 survey, the investigators explored the possibility of weighting inversely to response probabilities; however, post hoc weights had little influence on findings and have not been used extensively. One lesson to be learned is that a long mail survey is likely to be cognitively demanding. To encourage responses from respondents who are less able cognitively, a telephone interview may be a better strategy.

(D) Response rate of the 2003-2006 follow-up: 88%

A letter describing the forthcoming study was mailed to the

graduates to solicit their participation. Participants were informed that the study had a certificate of confidentiality from the Federal Government, and their identity would be strictly protected. Graduates were also directed to a public website containing information about the study. Almost 88% of living graduates were interviewed by phone. After completing the telephone survey, the graduate was mailed a self-administered questionnaire as long as 50 pages with two crisp new five-dollar bills clipped to the front page. After two waves of mailing and one final telephone contact, 88% of those who responded to the telephone survey completed the mail survey. This time, mail questionnaires supplemented to obtain key demographic information were sent to all individuals who refused to participate in the telephone interview, and the response rate was 40%. Thus, 92.3% of the living graduates responded to either the phone or the mail surveys. Some reluctant participants were mailed copies of a CD, *Billboard Magazine's* "Greatest Hits" of 1957, and that also increased the final response rate.

B. A Complete Record of Ability, Aspiration, and Achievement

A successful data collection is characterized by having quality and important measures which are often absent in other data sets. In early years, two measures from the WLS were especially valuable. One was respondent's cognitive ability, measured by the Henmon-Nelson Test of Mental Ability (Hauser, 2009). This cognitive measure is available for the WLS graduates, and in most cases, also available for siblings of the graduates and spouses of the graduates and siblings. Other researchers who have attempted to replicate the Wisconsin Model in other samples have often not been able to measure the same set of variables, for example, they lacked a measure of cognitive ability, and thus could not establish comparable findings (Sewell et al., 2003).

The second key variable in the WLS was a four-year average of parents' incomes from 1957 to 1960, obtained by Sewell from

files of the Wisconsin Department of Revenue (Hauser, 2009). This was a highly reliable measure of student economic background.

Over the years, the WLS has collected rich information about motivation, ability, families, careers, psychological well-being, and health. The content of the WLS was originally motivated by sociological interests, but it has been substantially extended to cover psychological, economic, and biomedical issues. The WLS is becoming an important resource for research on aging and the life course partly because its content was recently expanded to address biosocial concerns.

C. Use of Public or Administrative Record Data

Not all data were collected from the respondents. The WLS data are rich partly because they have been linked with public or administrative record data. Linked data include Henmon-Nelson Mental Ability test scores, rank in high school class, high school yearbooks which include senior-year photos and extra-curricular activities, earnings of parents from state tax records from 1957 to 1960, male graduate's earnings from 1957 to 1971, college characteristics, employer characteristics of 1975, National Death Index-Plus and Social Security Death Index, elementary and high school district resources from 1954 to 1957, Wisconsin health insurance plans, local health resources, medicare enrollment and claim data, and Wisconsin Worker's Compensation records. Other supplementary data include a link to the Wisconsin state tumor registry and geo-coded addresses.

D. Richness in Relational Data

To enhance the relational approach to the process of status attainment, the WLS has not only studied a large sample of Wisconsin students from high school graduation to retirement age, but also their parents, siblings, spouses, children, and friends. A

focal sibling was chosen at random for each WLS graduate who had at least one sibling, and the sibling data were collected as early as 1977. In the postcard survey of 1964, parents were directly contacted and they served as informants about the WLS graduates. After 1964, when the graduates and siblings were directly contacted, information about their parents came from administrative records or from graduates and siblings. The WLS also obtained a list of all children born to the WLS graduates by age and gender, and a focal child was chosen at random. The sample of children has not been studied directly, but the graduate (parent) was asked about his or her expectations for the child, and selected socioeconomic information has been obtained about the children after they reached adulthood. In the 2003-2006 follow-up, spouses were interviewed for information on social origins, social and economic characteristics, health, and family relationships. Finally, in 1975, each WLS graduate was asked to name their best, same-gender friends who graduated from the same high school in the same year (1957). About half the graduates had at least one named peer in the sample.

Interview data from siblings and spouses are a strength of the WLS. With these data, it is possible to cross-validate information about the graduates and their families, that is, to obtain repeated measures of the same variable. In addition, these relational data allow for multi-level models of family and individual effects on outcomes. Such multi-level models are useful to effectively remove unobserved family-level heterogeneity. Finally, siblings and spouses report unique information which cannot be obtained from the graduate research participants or other proxies.

E. Overlapping Questions in Multiple Surveys and Different Respondents

A feature of the WLS is having overlapping questions in different waves of data collection ascertained from different respondents (parents, graduates, siblings, and spouses). This feature

has generated repeated measures of key variables and made it possible to estimate a status attainment model with corrections for measurement error (Hauser, Tsai, & Sewell, 1983). Repeated measurements are not easy to obtain; they require either a high level of sample retention or proxy reports from well-informed others, such as family members (Hauser, 2009). Analytically, the use of repeated measurements for analysis requires advanced statistical modeling. The commitment to have repeated measurements was revealed in a statement of the WLS project director: “The distinctive scientific contributions of the Wisconsin project lie not merely in proposing the model, but in testing it by means of careful measurement—and repeated measurement—of key variables across the entire adult lives of the vast majority of participants in the study” (Hauser, 2009).

F. Resemblance and Coordination with Other Data Sets

To develop survey instruments, the WLS made reference to other well-designed surveys and coordinated ideas from members of successful longitudinal surveys in the U.S. and abroad. For example, in the 1975 follow-up study, the WLS measures and concepts resembled those of the Current Population Survey (CPS) and the 1973 Occupational Changes in a Generation Survey (OCG) (Featherman & Hauser, 1975, 1978; Hauser & Featherman, 1977). In the 1993 follow-up, some measures were made comparable with those of the Health and Retirement Study (HRS), National Survey of Families and Households (NSFH), NIH (National Institutes of Health) surveys of work and psychological functioning (Kohn & Schooler, 1983), and the General Social Survey (GSS).

The design of the WLS also benefited from coordination with members of the MacArthur Foundation Research Network on Successful Midlife Development, with Michael Marmot’s Whitehall II study (Marmot et al., 1991), and with Michael

Wadsworth's longitudinal cohort study of births in Great Britain in 1946 (Wadsworth, 1991). In sum, the WLS has paid close attention to the progress of other surveys and learned lessons from them.

G. A Large-Scale Population-Based Sample

It is an advantage to have a sample which is representative of a well-defined population. In the case of the WLS, findings can be generalized to all Wisconsin high school graduates of 1957. In addition, the WLS has a very large sample size, which allows for studies of special populations, such as a focused study of those who had children with developmental disabilities (Seltzer, Greenberg, Floyd, & Hong, 2004) or who themselves had low IQs (Seltzer, Floyd, Greenberg, Lounds, Lindstrom, & Hong, 2005). A large sample like the WLS would generate an adequate sample size for analyses of this kind. Moreover, as participants age, the WLS will yield a substantial number of respondents at advanced ages (Hauser & Willis, 2004).

H. Dissemination and Documentation of the Data

"If research participation is a public contribution, then data so obtained should be a public good" (Hauser & Willis, 2004: 215). With such a belief, the WLS has made a deliberate effort to share the data as well as to encourage their use by the research community. The WLS has created a public website to introduce the data, to register active users, and to allow for downloading of data, documentation, and publications: <http://www.ssc.wisc.edu/wlsresearch/>.

Project research activities have been documented from the early years of the WLS. Statistical computing, research operations, findings, decisions, and methodological notes were all recorded. The goal has been that "any research carried out in the WLS project should be reproducible by others, even if all of the present staff and faculty were to disappear from the scene" (Hauser, 2009: 49).

I. Flexibility in Research Directions

For a longitudinal study to be sustained for a long period of time there must be stable financial support. The WLS managed to survive for so long because the investigators changed and expanded research directions as the sample aged. The follow-up studies of 1964 and 1975-1977 were mainly driven by sociological interests, and the focus was on the process of status attainment. By the early 1990s, when respondents approached pre-retirement ages, the WLS would not have survived had the research focus not switched to cover topics that had become more important to respondents in their fifties, such as health, well-being, and retirement. By 2001, researchers of the WLS realized that the beginning of the era of biosocial surveys had arrived and a trend toward interdisciplinary approaches to the study of aging and the life course had begun (see also National Research Council [NRC], 2000, 2001, 2006a, 2006b, 2008). Thus, the 2003-2006 follow-up study was characterized by having a large and truly interdisciplinary group of researchers, representing a wide variety of scientific fields—traditional social sciences, epidemiology, neuroscience, and genetics.

J. A Research Study, Not a Data Collection Service

A data collection service collects data without proposing research. In the WLS, however, research and data collection are tightly-coupled. In 1964, for example, data were collected because the WLS researchers had studied the formation of aspirations, and it was time to learn whether the aspirations of the students had been realized seven years after their graduation from high school. In 1975, data were collected because there were limitations in the Wisconsin model of status attainment, and there was a need for more complete and more recent information about the sample. When the WLS applies for grants to collect data, the application comes with a series of specific research proposals. Funding has been granted only when research proposals show potential. This

screening process helps to promote research quality.

V. Suggestions for Future Follow-Up Studies of TEPS Students

For the first time, Taiwan has completed a national survey (TEPS) following individual students of two birth years (1985 and 1989) longitudinally across secondary school years. For a longitudinal survey of secondary school students, the TEPS presents itself as a very successful case. This successful story is likely to be extended, as forthcoming projects are to locate and interview TEPS students several years after high school graduation. Tracking the lives of subjects after high school is something that the WLS has done for decades. Here, we conclude this paper with several suggestions based on the experience of the WLS, with an understanding that some of these suggestions may or may not be helpful because each longitudinal survey may have its unique historical and cultural background, respondent characteristics, and methodological difficulties. These suggestions are specific to the future follow-up surveys of TEPS students after high school.

A. Choosing to Study a Less Selective Sample

One potential limitation of a school-based sample is selectivity. The major respondents of the WLS, for example, all graduated from high school in 1957. In 2001, the TEPS surveyed a large random sample of all seventh-grade students. Since 1980, nearly all (over 99%) Taiwanese children aged 6 to 11 have been in school. In 2001, over 99% of Taiwanese primary school graduates entered junior high schools. Therefore, the TEPS sample is least selective at Grade 7. Future follow-up studies will be most comprehensive if the population is defined to cover all seventh-grade students in 2001.

B. The Need to Oversample Some Minority Individuals and to Have a Large-Scale Sample

A limitation of the WLS is having a very small number of minority members. This limitation may not apply to TEPS because it sampled nearly 20,000 students at each grade level from a population which is ethnically diverse. In future follow-up surveys, the sampling design should enable researchers to analyze the experiences of population segments such as the economically disadvantaged, individuals with poor academic performance, and different ethnic groups.

To complete a follow-up survey with a larger sample size takes more time and resources. However, a very large sample size, such as that of the WLS, increases statistical power and allows for a study of special populations. As time goes by, it will yield a substantial number of respondents at advanced ages.

C. To Follow One or Two Cohorts?

The WLS is a single-cohort longitudinal study. The TEPS, however, is a two-cohort longitudinal survey, with one cohort born round 1985 and the other around 1989. When resources are limited, future follow-up surveys of TEPS face a trade-off between following (a) a single cohort with a large sample size or (b) two cohorts where each cohort has a smaller sample size. Whether or not a four-year difference in birth year (between 1985 and 1989) is significant and important is a question to be addressed. In some cases, cohort differences can be better evaluated with repeated cross-sectional surveys such as the General Social Survey in the U.S. and the Taiwan Social Change Survey, which allow for an inter-cohort trend analysis of a long time span. When a longitudinal survey is proposed, it is usually supported by a research agenda which will make the best use of the longitudinal nature of the data. If a between-cohort comparison is the major purpose of the study, data from repeated cross-sectional surveys

can be very useful, and repeated cross-sectional surveys are less costly than repeated longitudinal surveys.

D. Testing the Water before Diving in

Before tracing all 10,317 WLS graduates in 1975, researchers of the WLS traced a small subsample of 216 cases. Only when all 216 persons were found and when the WLS researchers had learned the lessons of this procedure, was it decided to undertake the large-scale tracing operation. Even when carrying out a large-scale tracing operation, the WLS did not begin by tracing the entire sample. Instead, the search started with a subsample, though each subsample was representative of the entire sample (Clarridge et al., 1977: 188). To trace and interview respondents, the WLS has been careful to prevent premature contacts, because multiple phone calls to the same respondent are likely to annoy respondents and raise the odds that some will refuse to cooperate. These are likely to be useful lessons for the TEPS when respondents are to be traced several years after high school graduation.

E. Exploring the Linkages to Administrative Records

The WLS showed that administrative data from official records can be linked to respondents. The TEPS may consider doing the same. Data from official records cover nearly 100% of the surveyed population, including those who refuse to be interviewed. In addition, data from official records may sometimes be more reliable than those collected from a survey.

F. Raising the Level of Survey Participation

The level of survey participation in a longitudinal study is likely due to many factors, such as the sample size, characteristics of the respondents, geographical dispersion, and the elapsed time

between waves of the survey. Clarridge et al. cautioned that tracing failure is likely due to (a) not exhausting all sources of information when searching for potential respondents and (b) leaving the search to those who have no interest in the research (1977). To achieve a high response rate, future follow-up studies of TEPS are likely benefit from a well-managed tracing operation, allocating sufficient resources for the tracing operation, persistence in trying to locate the difficult cases, and establishing anchor points (such as respondents' current addresses and telephone numbers) in each wave of data collection. A high response rate not only increases the sample size but also reduces the problem of non-random attrition.

G. Collecting Relational Data

The WLS has been expanded to interview not only the graduates, but also their siblings and spouses. In the future, adult children of the WLS graduates may be interviewed directly. Sibling data are not only useful for status attainment research, but also valuable for the study of health (Vogler, 2001). Future follow-up studies of TEPS students may include collection of sibling data. Even when there is no plan to interview siblings directly, some sibling information can be obtained from the original participants. For example, the respondent may be asked to report age (or birth year), gender, first name, and highest level of completed schooling for each sibling. These variables are likely to be helpful for a study of birth order, sibship size, and sibling resemblance in educational attainment.

H. The Need to be Interdisciplinary

The WLS 1957 baseline survey focuses on educational aspiration and planning beyond high school. The TEPS, however, covers a wide variety of topics related to high school life. For this reason, future follow-up surveys of TEPS students may support an interdisciplinary research agenda, so data collected before high

school graduation can be better used.

Since 1993, the WLS has paid attention to the issues of health and well-being. Therefore, in the 1993-1994 follow-up survey, the WLS included a variety of scales, measuring psychological well-being, personality, depression, family-work spillover (family stress spills over to work and work stress spills over into family life), goal attainment, hostility, health symptoms, anxiety symptoms, and body mass. In the TEPS, students were asked to answer some questions related to psychological well-being and health because they were likely to have a stressful life preparing for high-school or college entrance examinations. Future follow-up studies of TEPS students may want to develop well-defined measures of psychological well-being and health, with each measure being comparable across the life course. It will be better yet if each of these measures allows for international comparison.

There has been a discussion about whether population-based social surveys should collect biological measures (NRC, 2001). Since 2001, many social surveys, including the WLS and the Study of Health and Living Status of the Elderly in Taiwan, have started to collect biological data (Chang, Glei, Goldman, & Weinstein, 2008; Hauser, 2009; NRC, 2008). These biological measures may range from blood pressure to DNA, collecting from physical examination, blood sample, or urine sample of each respondent. Increasingly, population-based sample surveys are characterized by a combination of demographic, social, and behavioral data with biological measures. This signals a new direction for social surveys.

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探索高中之後的生命歷程： 「威斯康辛長期追蹤研究」的啟示

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摘要

「台灣教育長期追蹤資料庫」(Taiwan Education Panel Survey; 簡稱TEPS) 於二〇〇一年，針對國中一年級與高中二年級學生，進行全國性的研究調查。TEPS追蹤這些大約出生在一九八九與一九八五年的學生，直到高中畢業。隨著年齡增長，這些學生分別進入大學、勞動市場及婚姻關係。因此，新的追蹤計畫即將展開，以瞭解這些學生在高中之後的生活。美國的「威斯康辛長期追蹤研究」(Wisconsin Longitudinal Study; 簡稱WLS) 已經累積超過五十年的追蹤調查經驗。WLS以一九五七年威斯康辛州的所有高中三年級學生為母體，隨機抽取10,317個樣本，並從一九五七年開始，長期追蹤這些樣本至今。本文嘗試整理WLS的寶貴經驗，盼有助於台灣未來針對TEPS抽樣學生所做的長期追蹤調查。

關鍵詞：威斯康辛長期追蹤研究、台灣教育長期追蹤資料庫、長期追蹤資料調查、資料收集、生命歷程