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A Step Toward Understanding the Language Environment of Spanish-Learning Infants

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An Honors College Project Presented to  
the Faculty of the Undergraduate  
College of Health and Behavioral Sciences  
James Madison University

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by Hannah Lynn Schroyer

May 8<sup>th</sup>, 2020

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Accepted by the faculty of the Department of Communication Sciences and Disorders, James Madison University,  
in partial fulfillment of the requirements for the Honors College.

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PUBLIC PRESENTATION

The public presentation component has been waived due to the COVID-19 pandemic.

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### **Abstract**

In recent years, many studies have been conducted to improve the understanding of children's early language environments and how this impacts their long term development. Most studies of this nature focus on a single variable which has been found to have a major impact on childhood language environment, socioeconomic status (SES). SES has been found to impact both the number of words children hear and the quality of speech and language input that they receive. Children growing up in low-SES environments hear fewer words and lower quality speech, which has been shown to cause delayed language development and decreased long term cognitive and educational outcomes. While this has been well established for low-SES English-speaking families, there has been little research done confirming that the same phenomenon is true for low-SES Spanish-speaking families. Considering the variables of language and culture, it is extremely possible that entirely different patterns may emerge for Spanish-speaking families. With the growing demographic of Spanish speakers in the United States, it is becoming increasingly important to understand how Spanish speaking families differ from English speaking families so that professionals working with these families can implement the most appropriate supports. This paper will discuss the existing literature regarding home language environment, a proposed method for data collection, and important considerations for researchers based on our research team's experiences.

### **The Language Environment of Low-Socioeconomic Status Spanish-Learning Infants**

In the United States, Hispanics are currently the largest minority group, with a population of 58.9 million that is projected to almost double by 2060 (“Hispanics in the US,” 2019). Increased immigration, not only from Mexico, but from all of Latin America, has been the primary driving force for this shift (Flores, 2017). The number of second and third generation Hispanics is also growing rapidly, as the immigrants of past generations have children and grandchildren of their own. In addition, 37 million people in the United States speak Spanish in the home, more than in any other time in US history (Flores, 2017). However, despite this growing demographic, there has been only minimal research conducted to understand the language environment of the infants in these families.

Understanding this population is important for Speech-Language Pathologists (SLPs), early interventionists, social workers, teachers, and any other individuals who work with young children, as a high-quality language environment significantly impacts long term vocabulary knowledge and cognitive outcomes. Research has shown that the quality of the home language environment is highly correlated with socioeconomic status (SES), and Latino children are more than twice as likely to grow up in poverty than their non-Latino counterparts (“Children in poverty,” 2018), a finding which emphasizes the importance of studying their language environment. Without an understanding of the quantity and quality of language that low-SES Spanish-learning infants are exposed to, it is difficult if not impossible for SLPs or other professionals to plan effective interventions for these children and their families.

Despite the importance of this body of research for understanding child development and improving outcomes for young children, researchers do not yet know whether the same factors

that influence the development of English-speaking infants apply to Spanish-speaking infants. Cultural factors may have unexpected impacts on the language development of children in these families. Spanish-speaking families cite barriers to book reading, for example, but engage regularly in singing and storytelling with their children (Jimenez et al., 2018). These alternative activities may provide the stimulating, language-rich environment that aids in the development of language skills. While it is shown that SES tends to impact the language environment of English-speaking infants, cultural factors may have greater influences on how SES correlates with the development of Spanish-speaking infants.

### **Background**

Low-SES parents face challenges that extend far beyond economic struggles. SES has a profound impact on all aspects of family life, including free time, transportation, nutrition, and healthcare. Low-SES families experience stressful life events with a greater quantity and severity than mid- or high-SES families (Walker, 2016). Living in a low-SES environment can impact all aspects of family life including child development, as stressful life events and increased challenges can make it much more difficult to provide a highly stimulating environment for young children.

It has been well established in the field of infant language development that the quantity and quality of language input affects long-term outcomes with respect to education, cognition, and vocabulary. Children from low-SES families hear fewer words in their day to day lives compared to higher SES children. Therefore, low-SES children are most at risk for the deficits that result from a lack of exposure to high quantity and quality language. Hart and Risley's (1995) landmark study comparing low, mid, and high-SES children showed that by age four, low-SES children were estimated to have heard an average of 30 million fewer total words than their high-SES peers. Some researchers have called into question the validity of the Hart and Risley study and suggest that the Hawthorne Effect, or the influence of a researcher's presence on the behavior of participants, may have greatly inflated the results of this study. Despite these criticisms, there is little question that a gap exists, even if it may not be as large as 30 million words (Gilkerson et al., 2017; Sperry, Sperry, & Miller, 2018). This gap in language exposure also impacts expressive vocabulary—that is, the number of words that children are able to produce. At 36 months, the expressive vocabulary of low-SES children was found to be half the



size of the high-SES children, on average (Hart & Risley, 1995). Not only are there measurable differences in language environment and vocabulary prior to three years of age as a result of SES, but these disparities follow a child throughout life.

The effect of this disparity is long lasting and has a great deal of predictive validity. For example, a child's vocabulary at 30 months is predictive of his or her literacy skills upon entering kindergarten (Rowe, Raudenbush, & Goldin-Meadow, 2012), and children who are behind their peers in kindergarten are likely to stay behind throughout their school careers (Stanovich, 1986; Walker, Greenwood, Hart, & Carta 1994). A majority of SES-related disparities develop prior to age three (Farkas & Beron, 2004), and these disparities are predictive of standardized test performance at age eight (Marchman & Fernald, 2008). Therefore, the first three years are of particular importance with regards to vocabulary growth and language development, as these disparities emerge early and follow children throughout their lives.

Studies exploring the language environment of infants have focused on two primary aspects of language environment—quantity and quality, and SES has been found to affect both factors. Quantity refers to the number of words heard by infants in their day to day environment, and as discussed, this gap in word exposure can affect long term outcomes (Hart & Risley, 1995). Quality, on the other hand, refers to the strategies that many caregivers instinctively use when addressing infants such as longer utterances, positive teaching strategies, richer vocabulary, production of words in isolation, and certain acoustics characteristics such as increased pitch and prosody. Collectively, these characteristics make up what is known as infant directed speech (IDS)—the high-quality speech that many caregivers instinctively use when talking to infants. IDS has been found to facilitate language development (Hoff & Tian, 2005;

Hoff, 2003; Hurtado, Marchman, & Fernald, 2008; Schwab & Lew-Williams, 2016). Infants who experience less exposure to high-quality language have fewer opportunities to retrieve word meaning. As a result, they must devote more cognitive effort to processing and understanding common words, leaving fewer cognitive resources available for learning new words and continuing to increase their vocabulary (Fernald, Marchman, & Weisleder, 2013). The more words a child knows, the faster he or she can learn new words, which results in the vocabulary knowledge gap growing over time. The foundations of language in the first three years of life are vital to facilitating the development of a typical vocabulary. This research on the quantity and quality of speech in an infant's environment provides a robust understanding of how infants learn language. However, most of the research that exists has been done with families who speak English, and little is known about speakers of other languages.

It is becoming increasingly important to understand the language environment of children being raised in low-SES Spanish-speaking families, as this demographic continues to grow within the United States (as outlined above). Research on the language development of Hispanic children in the United States has been mostly restricted to post-school entry, when the children are exposed to English and become sequential bilinguals (Wood, Diehm, & Callender, 2016). Little, however, is known about their language exposure in Spanish prior to the introduction of English as a second language due to the challenges associated with recruiting and studying infants and toddlers before they enter school. This is an important consideration as it has been shown that a children's competence in their first language greatly influences how quickly and effectively they will acquire a second language (Sparks, Patton, Ganschow, Humbach, &

Javorsky, 2008). Therefore, there is a growing need for scholars to understand these children's acquisition of Spanish, as it will influence their acquisition of English upon school entry.

The existing research on the language development of Spanish-learning infants has focused primarily on language processing efficiency, a skill which is greatly influenced by the early childhood language environment. According to several studies, the quantity and quality of the language input that a child receives at 18-19 months of age can predict vocabulary and language processing efficiency at 24 months in infants learning both English (Fernald et al., 2013) and Spanish (Hurtado et al., 2008; Wisleder & Fernald, 2013). Because language exposure influences processing efficiency, it is not surprising that there are measurable deficits in the speed and accuracy of language processing in infants from low-SES families in one to 3-year-old Spanish-learning infants (Hurtado, Marchman, & Fernald, 2007). The language processing deficits that have been discovered suggest that a similar correlation exists between language exposure early in life and cognitive outcomes for Spanish-learning infants that has been well-established in English-learning infants. However, these deficits cannot be confirmed without research that quantifies and explores the language environment of Spanish-learning infants.

Some studies suggest even more concerning outcomes for low-SES Spanish-speaking children than their low-SES English-speaking peers. One study comparing maternal knowledge about child development between white, black, and Latino mothers found that Latino mothers scored the lowest on the Knowledge of Child Development Inventory (KIDI), which has been correlated with decreased language and literacy outcomes for the child (Rowe, Denmark, Harden, & Stapleton, 2015). Based on an analysis of the Early Childhood Longitudinal Study–

Birth Cohort (ECLS-B), Hispanic children and children who speak Spanish in the home were found to be significantly behind non-Hispanic English-speaking children at both nine and 24 months on the Bayley Cognitive Assessment. This disparity widens significantly by 24 months, which emphasizes the importance of intervening early (Halle et al., 2009). Additionally, one to three-year-old monolingual Spanish-learning children have smaller vocabularies on average compared to monolingual English-learning children of the same age (Hurtado et al., 2007). These findings suggest that low-SES Spanish-learning infants may hear less high-quality speech than low-SES English-learning infants.

More research is needed to understand the language development of low-SES Spanish-learning infants, given the potential for long term detrimental outcomes. This could be achieved using the LENA (Language ENvironment Analysis) audio recording device and software. LENA data is available for low-SES English-speaking families as a comparison point. The proposed study consists of LENA analysis, parent demographic information, and orthographic transcription of the one hour following the infant's nap.

### **Design & Methodology**

This proposed methodology seeks to explore cultural and linguistic differences in caregiver-infant speech by analyzing primary caregivers in a Spanish-speaking families. The data will be compared to English-speaking data from the same geographical region.

### **Participants**

The participants for this study are children 8-months of age. The language environment of infants changes once the infants begin to speak, so it is best to evaluate infants prior to their first spoken words to best understand their early childhood language environment. Most studies of this nature study the mother-infant interactions. Some potential exclusion criteria are a high percentage of English spoken in the household, premature infants, infants with other disabilities or delays, and infants with regular inner ear infections.

### **Recruitment**

Recruitment should be a particular focus for this population, as it may be difficult to gain trust within the appropriate communities. Recruiting community partners who already work with Spanish-speaking families is a great way to gain the trust of these families more quickly. There are many organizations that will already have regular interactions with low-SES Spanish-speaking families who will be able to locate and recruit them more easily. For the families participating, this may ease their concerns about the intentions of the research team and allow them to feel more safe and protected throughout the study. A flyer was developed to assist in the recruitment of families for this study (Appendix A). Flyers were placed in locations where Spanish-speaking families are likely to regularly go, such as Spanish-speaking daycares and churches and Hispanic markets and shopping centers. In order to assist with recruitment, a \$70

stipend was offered to encourage participation. Researchers should be aware of the ethical impact of the stipend. For many families, it will likely be the only reason that they choose to participate. Researchers should consider the level of discomfort that families may feel due to the invasive nature of this study and work to ensure the comfort and security of the family throughout their time participating in the study.

### **Procedures**

Once families were recruited for the study, the research team collected preliminary data to ensure that the family met the requirements of the study and that none of the exclusion criteria were applicable. The researchers should be open to traveling to a comfortable location for the family, such as their home or another agreed upon location. Transportation may be a concern for low-SES families so researchers should not expect them to travel to a research lab in order to participate. At the agreed upon location, the researchers reviewed the informed consent form, assisted the caregivers in completing the questionnaire, and explained how to use the LENA device. The questionnaire (Appendix B- English, Appendix C- Spanish) collects demographic information about the mother, father, and any other individuals or caregivers who are present in the home, as well as information about the infant's health and development.

After completing the consent form and questionnaire, the family was left with an activity diary and LENA recording device (Appendix D). LENA is a device that is capable of collecting 16 hours of audio of an infant's day to day interactions. The LENA device is completely safe for babies to wear, and fits inside a pocket on a vest or t-shirt (LENA, n.d.). For two days, the infant wore the LENA device, and LENA collected audio recordings of the caregiver-infant interactions. The family may remove and turn off the device for any naps or necessary outings,

but particularly busy days where they will be out of the home frequently should be avoided in order to obtain the most useful data. The family kept an activity diary (Appendix E- English, Appendix F- Spanish) over the two days so that the researchers may locate specific segments of the audio recording for further analysis. The families received a total of \$70 each for their participation in the study in order to encourage participation. They received \$20 at the start of the study and the final \$50 when they returned the LENA device and activity diary after the two days of recording.

### **Analysis**

The data collected from the Spanish-speaking families was statistically analyzed for comparison with the data previously collected from English-speaking families. LENA software is able to estimate the total number of words (AWC) directed at the child, conversational turns (CTC) between adult and child, and child vocalizations (CVC). The accuracy of LENA's estimations compared to human transcribers was found to be about 82% for adult utterances and 76% for child utterances (Xu, Yapanel, & Gray, 2009). LENA has been validated for use with speakers of many languages, including Spanish (Weisleder & Fernald, 2013). LENA norms are also available on the software for recordings longer than 10 hours, although SES and ethnicity data is not available.

Additionally, one hour of each LENA recording was orthographically transcribed and analyzed in greater detail in order to compute and compare additional measures such as mean length of utterance (MLU) and word repetitions. The recommended hour to be transcribed and analyzed is the hour following the infant's nap. This hour was chosen because it typically provides opportunities for the production of high-quality language, as there are usually many

highly stimulating activities that take place at this time of day, such as diaper changes or feedings. The infant's nap can be easily located on the recording from the audio diary that the caregiver provides.

From LENA and the one hour transcript, the following metrics are available for comparison: adult words (AWC), child vocalizations (CVC), conversational turns (CTC), total number of infant directed words, mean length of utterance (MLU), and adult isolated words. These variables are of particular importance in assessing the quantity and quality of infant directed speech (IDS).

Socioeconomic status was estimated from a combination of parental education and occupation from the questionnaire completed by the family. Each parent was given an educational index score and an occupational index score (Appendix G). This two factor SES scale is adapted from Nittrouer's work (Nittrouer, 2009). The Hollingshead 4-Factor SES method computes SES in the following manner:

*(Maternal Occupational Index x 5) + (Maternal Educational Index x 3) = Maternal Score*

*(Paternal Occupational Index x 5) + (Paternal Educational Index x 3) = Paternal Score*

*Paternal Score + Maternal Score / 2*

For single income households, only the score of the working parent was computed. The families were then divided into the following social strata:

<b>Social Strata Range of Computed Scores</b>	
Major business and professional	66-55



Medium business, minor professional, technical	54-40
Skilled craftsmen, clerical, sales workers	39-30
Machine operators, semiskilled workers	29-20
Unskilled laborers, menial service workers	19-8

Raw scores were compared among participants, or a score of less than 30 could be reasonably considered low-SES for the sake of this study.

### **Results and Discussion**

The study described above has not been conducted in its entirety to this point, however, the LENA computations for a single family will be briefly discussed. This family is not ideal for the study design in a few ways: the primary caregiver who was analyzed was the paternal grandmother, not the mother (although the child did split his time between the two households) and the child was 11 months, 18 days and therefore, too old to be compared to the data set of English-speaking families. Finally, this family could best be described as low-mid SES. This family did allow for the research team to begin to consider the language environment of a family who spoke only Spanish with the child, our primary variable of interest, but more strict recruitment criteria should be maintained for a complete study of socioeconomic status and home language's impact on the language environment of infants.

The research team was still interested in conducting a LENA analysis for this family in order to test the effectiveness of the procedures and work toward establishing a hypothesis for

other Spanish-speaking families. Findings indicated some interesting trends compared to the norms reported by LENA (no ethnicity or SES data is available for these norms).

<b>Category</b>	<b>Spanish-Speaking Family</b>	<b>LENA Percentile</b>
<b>Adult Word Count (AWC)</b>	25,474	>90
<b>Conversational Turns (CT)</b>	430	70
<b>Child Vocalizations</b>	983	33

Note: LENA norms are based on a 12 hour sample so counts for this family were used to estimate a 12 hour total.

Most notable in these findings is the sheer number of adult words directed at the infant. While these numbers only represent a single family, it is clear that this child is being raised in an extremely language rich environment with ample opportunity to learn language given the research cited above. The number of adult words, 17,700, represents the 90th percentile over 12 hours so 25,474 represents an incredible number of child directed speech. If the same trends are found to exist for lower-SES Spanish-speaking families, it would provide significant evidence that the language environment of low-SES Spanish-learning infants is extremely well suited for language learning. Further analysis of additional Spanish-speaking families will be necessary in order to determine if the same trends exist throughout the Spanish-speaking population.

### **Recommendations for Future Researchers**

Studying the language environment of infants who are learning Spanish at home is extremely important for improving long-term outcomes for these children. A dearth of research exists in this area, making it especially important for researchers to delve into this topic. Future researchers should pay particular focus to ethics, recruitment, and language barriers.

In any research study, ethics must be one of the primary considerations for the researcher. However, ethics is an even more important consideration when working with vulnerable, low-SES, minority families. The researcher should be aware of ethical factors throughout the research process. Many low-SES Spanish-speaking families may be illegal immigrants and may have a distrust for researchers and may be reluctant to share personal information with the research team. It is very important to assure the families that their data will not be shared with anyone outside of the research team and to respect if families choose not to participate for this reason.

Recruiting participants from this population should be of particular focus for researchers interested in studying Spanish-speaking families. The nature of this research is incredibly invasive. Asking families to bring a recording device into their homes and record every detail of their day is a major ask of vulnerable families. Families of any ethnicity may feel uncomfortable participating in research of this nature, even with a monetary incentive. There are many factors that make Spanish-speaking families particularly vulnerable and unlikely to want to participate, such as immigration status, the language barrier, or unfamiliarity with research protocols.

Researchers should also make preparations to address the language barrier. If possible, researchers should familiarize themselves in advance with the dialect that the family speaks in order to allow for the most effective communication possible. It would also be beneficial to have a native Spanish-speaker serve as part of the research team. Particularly with regards to the transcriptions, many region-specific words, phrases, and songs may be used when interacting with the infants that non-native speakers may not be able to comprehend.

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**Appendix A: Recruitment Flyer**

# ¡HOLA PADRES!

**¿Tienen un bebé de 11 meses o menos?**

Si tienen un bebé de 11 meses o menos que es el único niño en el hogar y su familia habla español en la casa, queremos su participación en un estudio sobre el habla de los bebés. Le pagamos \$70 por su participación.

Usarán un aparato que se llama LENA para grabar en audio su vida normal por dos días. Los investigadores no van a escuchar la grabación con la excepción de una hora para estudiar cómo aprenden la lengua los bebés.

NECESITAMOS AYUDA  
CON UN ESTUDIO DEL  
HABLA DE LOS BEBES

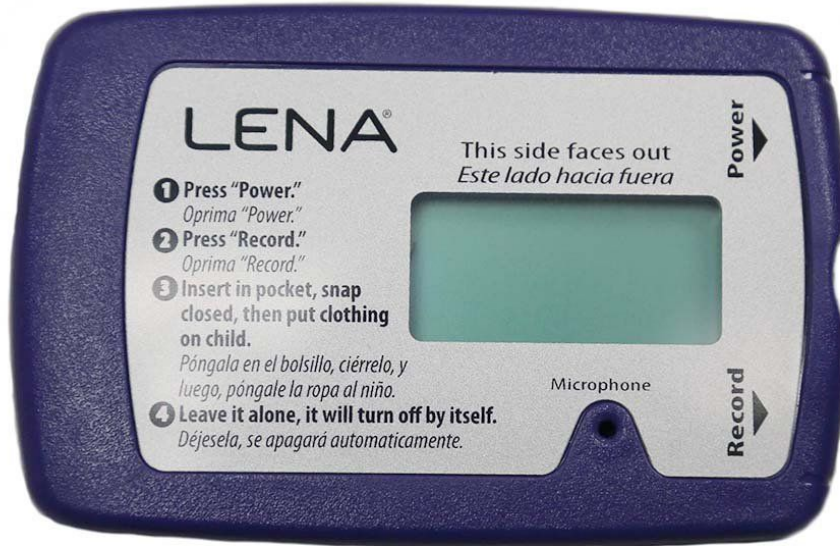
LE PAGAMOS \$70  
POR SU  
PARTICIPACIÓN

SOLO NECESITAS  
GRABAR CON AUDIO  
SU VIDA NORMAL POR  
DOS DIAS

**CONTACTAR:**

**HANNAH SCHROYER**  
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**Appendix B: LENA Recording Device and Clothing**

**Appendix C: Parent Questionnaire (English)**

Maternal Speech and Infant Vocalizations Study

Family profile

CHILD'S NAME \_\_\_\_\_

BIRTH DATE \_\_\_\_\_ BIRTH PLACE \_\_\_\_\_

	MOTHER	FATHER
Name		
Birth date		
Accent		
Occupation		
Highest level of education completed		

OTHER LANGUAGES to which child is exposed (indicate language, speaker and how often child is with speaker) \_\_\_\_\_

OTHERS living at home besides infant mother and/or father \_\_\_\_\_

OTHER CARETAKERS (approx. amount of time per week spent with them) \_\_\_\_\_

IS your infant babbling? If yes, at what age did (s)he start \_\_\_\_\_

IS your infant gesturing (for ex. pointing)? If yes, at what age did (s)he start \_\_\_\_\_

HAS your infant had any hearing problems or recurrent ear infections? \_\_\_\_\_

IS your infant healthy? If not please describe the issues or problems your infant has had.

**Appendix D: Parent Questionnaire (Spanish)**  
 Estudio de la voz materna y vocalizaciones infantiles  
 Perfil de la familia

NOMBRE DEL NIÑO \_\_\_\_\_

FECHA DE NACIMIENTO \_\_\_\_\_ LUGAR DE NACIMIENTO \_\_\_\_\_

	MADRE	PADRE
Nombre		
Fecha de nacimiento		
Dialecto		
Oficio		
Nivel más alto de educación completado		

OTROS IDIOMAS a los que el niño está expuesto (indique el idioma, el orador y la frecuencia con que el niño está con el orador) \_\_\_\_\_

OTROS que viven en casa además de la madre y/o padre del bebé \_\_\_\_\_

OTROS CUIDADORES (cantidad aproximada de tiempo por semana que pasa con ellos) \_\_\_\_\_

¿Su bebé balbucea? \_\_\_\_\_

De ser así, ¿cuándo comenzó a hacerlo (es decir, a los cuántos meses/años)? \_\_\_\_\_

¿Su niño hace gestos (por ejemplo, apunta con el dedo)? \_\_\_\_\_

De ser así, ¿cuándo comenzó a hacerlo (es decir, a los cuántos meses/años)? \_\_\_\_\_

¿Ha tenido su bebé algún problema auditivo o infecciones del oído con frecuencia? \_\_\_\_\_

¿Su bebé está sano? De no ser así, por favor describa las cuestiones o problemas que su bebé ha tenido: \_\_\_\_\_





### Appendix G- Occupational and Educational Indices

*From Susan Nittrouer, Early Development of Children with Hearing Loss (2009)*

#### Occupational Index

<b>1=</b> maid, parking lot attendant, cafeteria worker, welfare recipient	bank teller/clerk, engraver, mechanic, beautician, service technician, janitor, carpet installer, brick mason, security guard, maintenance worker
<b>2=</b> fast food worker, meter reader, housekeeper, deliveryman, garbage man, packer, housewife, bill collector, telemarketer, waiter/waitress (e.g. bars), butler, factory worker, taxi driver, telephone operator, assembly line worker, data entry, nanny, bartender, painter (e.g. house), dishwasher	<b>4=</b> barber, travel agent, proofreader, baker, plumber, insurance agent, farmer, florist, sales representative, court reporter, fast food manager, electrician, tailor, locksmith, jeweler, bookkeeper, undergraduate student, carpenter, corrections officer, piano teacher, loan officer, factory supervisor
<b>3=</b> daycare worker, construction worker, dispatcher, home appliance repairman, truck driver, bus driver, print room operator, roofer, sales clerk, waiter/waitress (higher), brewer, camp counselor, dry cleaner, butcher, chef at a diner, exterminator, telephone company technician, mailman, car salesman, retail sales, military enlisted, post office clerks, welder, auto body repairman,	<b>5=</b> advertising agent, actor/actress, construction foreman, librarian, interior decorating, real estate broker, missionary, funeral director, artist, laboratory technician, chef at a good restaurant, insurance adjustor, manufacturer, oral hygienist, musician, tavern owner, electrical contractor, L.P.N., public relations, social worker, executive assistant, office manager, radio/TV

announcer, store manager (chain), executive  
 secretary, personnel manager, accountant,  
 contractor, graduate student, mortician,  
 policeman, postmaster, fireman, medical  
 technician, bank manager, firefighter  
**6=** computer programmer, restaurant owner,  
 store or small business owner, elementary  
 school teacher, research assistant, book or  
 magazine editor, optician, real estate  
 developer, stockbroker, high school teacher,  
 military captain/liutenant, chiropractor,  
 registered nurse, military officer, lawyer,  
 sheriff/police chief, clergyman, pharmacist,  
 family therapist  
**7=** mayor, symphony conductor, engineer,  
 large business owner, school principal,  
 architect, judge, psychologist, veterinarian,  
 company president, university professor,  
 dentist  
**8=** university president, scientist, physician,  
 surgeon

### **Educational Index**

**1.0=** Completed elementary school  
**2.0=** Completed junior high  
**2.5=** Received Graduate Education  
 Equivalence  
**3.0=** Completed high school  
**3.5=** Completed 1 or more years of  
 technical/vocational school  
**4.0=** Completed technical/vocational school  
**5.0=** Completed 1 or more years of  
 university/college  
**6.0=** Bachelor's degree  
**6.5=** Completed 1 or more years of graduate  
 school  
**7.0=** Master's degree  
**7.5=** Course work completed for PHD but  
 no dissertation; law degree without bar;  
 medical degree without internship  
 completed  
**8.0=** PhD; law degree with bar; medical  
 degree with internship completed