THE EFFECTS OF AGE, COGNITION, AND MOTIVATION ON GPA AMONG COLLEGE STUDENTS AT THE UNDERGRADUATE LEVEL

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAI'I IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER’S OF EDUCATION IN EDUCATIONAL PSYCHOLOGY

DECEMBER 2011

By
Bueno Chen

Thesis Committee:
Katherine T. Ratliffe, Chairperson
Seongah Im
Michael Salzman
We certify that we have read this thesis and that, our opinion, it is satisfactory in scope and quality as a thesis for the degree of Master of Education in Educational Psychology.

THESIS COMMITTEE

Chairperson
ABSTRACT

This study examines the growing number of nontraditional college students returning to college and suggests there may be cognitive implications for older nontraditional college students over 40 years old in relationship to GPA. This project included two studies. The first study recruited two participant groups (n=20 and n=204) to assist in creating a survey instrument and to confirm its validity and reliability. The second larger study recruited 334 participants from the University of Hawai‘i -West O‘ahu and Leeward Community College to explore the effects of age, cognition, and intrinsic motivation on grade point average among three groups of undergraduate college students, traditional students from 18-24 years of age, younger nontraditional students from 25-40 years, and older nontraditional students who were over 40 years of age. Cognition included the categories of encoding, memory, and attention. A multiple Regression model demonstrated that only intrinsic motivation predicted GPA for college students at the undergraduate level. This would imply that a student having adequate amounts of intrinsic motivation could achieve academic success in relationship to GPA levels.
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Chapter 1

Introduction

Several studies report that from 1970 to the present, there has been a significant increase in nontraditional students returning to and attending colleges and universities (Bauman, et al., 2004; Fairchild, 2003; Kinsella, 1998; Neal, 2008; O’Brien & Merisotis, 1996; Taniguchi & Kaufman, 2005). A nontraditional college student is generally over the age of 24 years, absent from college for one or more years after high school, and has other life responsibilities such as full-time job or caring for a family (Benshoff, 1993; Fairchild, 2003; Neal, 2008). These nontraditional students make up at least 50% of the college and university undergraduate population and are becoming the fastest growing student group in North America (Belcastro & Purslow, 2006; Benshoff, 1993; Bye, Pushkar, & Conway, 2007; Laanan, 1999; Neal, 2008). Nontraditional college students have different characteristics, strengths, and restrictions compared to the traditional college student, aged 18-24 years (Choy, 2002; Justice & Dornan, 2001; Laanan, 1999).

In addition, there is a growing number of older nontraditional students returning to college. For example, by the late 1980s, there was a 33% increase in students over age 35 (James & Sonner, 2001). I am particularly interested in college students over 40 years old, because these students may have different cognitive challenges compared to younger, more traditional college age students. The increasing number of older college students (over 40 years old) merits more study about their strengths and restrictions. Unfortunately, there is limited
information on college students over the age of 40 who make up a significant portion of those college students referred to as “nontraditional.” However, analysis of the available information on typical nontraditional students may provide some insight into the characteristics of these older students.

According to Belcastro and Purslow (2006), the enrollment and attendance of nontraditional students is now larger than traditional college students in most U. S. academic institutions. Several studies suggested that this increasing enrollment will have an effect on the way colleges and universities address the nontraditional students’ needs and learning characteristics. Academic institutions may need to address issues related to institutional size, teaching styles, educational resources, socioeconomic necessities and expectations, individualized attention, standards of academic performance, and peer group supports as well as special advising and orientation, more evening and weekend classes, and special assistance with financial aid to accommodate the rising numbers of nontraditional students (Belcastro & Purslow, 2006; Benshoff, 1993; Fairchild, 2003).

The purpose of this study is to determine whether differences in age, cognition (encoding, memory, and attention), and intrinsic motivation explain differences in GPA among college students at the undergraduate level. Encoding refers to the way a person takes in information and transfers it into memory (Bruning, Schraw, Norby, & Ronning, 2004; Goldstein, 2008). I will examine the characteristics of older nontraditional students (over 40 years old) to determine what benefits they have over younger students, and what obstacles they may face in terms of their academic skills and proficiencies. Since little information is
available on this specific population, I will use the larger category of nontraditional college students (25 years and up) as a framework to infer characteristics of older nontraditional college students, those over the age of 40 years. I have grouped college students into three categories: traditional (18-24 years), younger nontraditional (25-40 years), and older nontraditional (over 40 years). This study will explore how academic characteristics differ between traditional, younger nontraditional and older nontraditional students. This paper will also identify the strengths of older nontraditional students, for example their use of greater life experiences towards analogies and intrinsic motivation (Benshoff, 1993; Bye, Pushkar, & Conway, 2007; Eppler & Harju, 1997; Justice & Dornan, 2001; Laanan, 1999; Richardson, 1994). In addition, I will describe their obstacles such as life style demands, and possible cognitive implications of the older nontraditional college student. This study will contribute to the existing literature and research on nontraditional students in relationship to their GPA, age, intrinsic motivation, and cognition (encoding, memory, and attention).

The following sections will address (a) the history of nontraditional students, (b) a description of the current nontraditional student, (c) reasons why these students are returning to college, (d) benefits and obstacles of being a nontraditional college student, and (e) possible cognitive deficits that may face the older nontraditional college student. I begin with the history of nontraditional students.
Chapter 2: The Nontraditional Student

History of Nontraditional Students

Early adult education practice can be documented as far back as to ancient Greece. People gathered around philosophers such as, Socrates, Plato, and Aristotle in hopes to extend their education and gain knowledge (Stubblefield, 1988). Adult education in the United States may have started as early as 1727 with Benjamin Franklin who, at the time, had an idea to pursue higher learning for adults. Originally, he formed a group called Junto, a secret society made of twelve men who met to discuss interesting topics of science, philosophy, and political themes. The group members eventually grew and motivated Franklin to pursue the group’s goal and its possibilities to further adult learning. It is not conclusive that Franklin’s contribution had an influence on higher learning for institutional systems; however, he is considered one of the earliest pioneers of adult learning in the United States (Moreland & Goldstein, 1985). The term nontraditional student was not created until later and can be understood better through an explanation of normal schools.

In 1839, normal schools were the first to incorporate nontraditional students (Ogren, 2003). Most normal schools were coeducational except for a few in the Southern United States which were restricted to women only. Normal schools later adopted the name “normal colleges” and were the first to provide elementary-level teaching certificates. The majority of normal colleges were renamed as “teacher colleges” by the 1920s and provided bachelor’s degrees. From 1920 to 1940, teacher colleges primarily produced teachers. The end of
World War II (late 1940s), accompanied by the G.I. Bill, brought a tremendous increase in the number of veterans seeking a broader range of college degrees (Portman, 1978). This prompted many colleges to expand their range of programs, leading to the development of state colleges from California to New York. In addition, once former normal schools became state universities in the regions from North Michigan to Southwest Texas.

Nontraditional students in the mid 1870s were mostly women, because teachers were mostly women at the time (Ogren, 2005). With each passing decade, the number of nontraditional male students increased as well. In addition, there was an increase of European immigrants in the later part of the 1800s. Many of these were Germans and Scandinavians that made up the largest of the European immigrant population. Most of them did not speak English; however, many of their children, after completing public school and after a few years working, became nontraditional students (Portman, 1978).

The common characteristics of the early nontraditional students were: (a) lower social economical status, (b) mostly females, (c) part-time enrollment, (d) commuting, sometimes many miles, and (e) minority status. They worked hard to support themselves in hopes of achieving a higher education (Ogren, 2003; Zwerlin, 1992). Females may have worked as babysitters or maids, while males shoveled snow, or worked as salesmen or janitors in order to support themselves through their college education. The President of Illinois State Normal University in 1882 complemented nontraditional students, claiming they were hard working and dependent on their own means of financial support (Ogren, 2005).
In a contrasting description of historical nontraditional college students, Orgen depicts their personal characteristics as unpolished due to living in isolated areas. He described them as seeming awkward and reserved. Many were unrefined or lacking culture and did not have adequate table manners or know what to do in various occasions dealing with social etiquette. However, their unpolished character and lack of worldly wisdom were due to limited exposure to the larger world outside their small towns and rural areas such as ranches and mining towns.

Coinciding with the increase of nontraditional students, administration, faculty, and government programs in the late 1800s created more accessibility and affordability for underprivileged students (most of whom were nontraditional students) to enter higher education. This was done through means of government tuition funding through grants, subsidies, and scholarships which afforded easier standards of admission for these students entering colleges. By 1888, the average age of students in normal schools was 26-28 years (Ogren, 2003). It was not long before certain colleges and universities developed the reputation for serving students of underprivileged backgrounds. In addition to other accommodations for nontraditional students, in the 1920s evening classes were being established at colleges and universities to meet the demand for these students (Portman, 1978).

These early nontraditional students were similar to current nontraditional students in that most were over the age of 25 and were supporting themselves while attending college. However, current literature includes more information about today’s nontraditional college students, describing their differences from
their younger traditional-aged counterparts in several important ways that will be described in the next section. These characteristics are not entirely exclusive but help to differentiate between the two groups, as well as give some insight into current older nontraditional college students (over 40 years old).

**Current Nontraditional Student**

Nowadays, nontraditional students are defined as those over the age of 24 who are returning to school after a year or more absent from college. They are often married with children or are single parents and working (Benshoff, 1993; Fairchild, 2003; Neal, 2008). Many are consumer oriented and see the value of education as an investment (James & Sonner, 2001). Often, they lack similar age cohorts; therefore, they are deficient in social networks and support (Benshoff, 1993; Laanan, 1999). Their college status is usually part-time, along with a 35-hour or more work week to sustain their livelihood (Jinkens, 2009). They are considered financially independent in regards to eligibility and consideration for financial aid (Choy, 2002) Nontraditional students may also have dependents other than their spouse or children; they may be caring for their parents, grandparents, or other relatives (Choy, 2002; Kinsella, 1998). See Figure 1 (Appendix A) for further information regarding the growth and characteristics of nontraditional students.

Another category of nontraditional students, which makes up an important segment of the increasing enrollment of older nontraditional students, is returning “baby boomers.” Boomers were born between the years of 1946 and 1964.
The Effects of Age

(Dohm, 2000). In 2006, there were about 78 million boomers in the United States, equating to about 26.1% of the total U.S. population (U.S. Census, 2010).

Nontraditional students, including boomers, return to college for multiple reasons. Some are searching for personal enrichment. Many however, wish to obtain new job skills, update skills to keep their present jobs, navigate life transitions (divorce or death in family), or are searching for new professions because they are simply unable to continue physical work (Sander, 2008). Although increased earnings, recovering from a job loss, or changing careers are some of the main reasons for returning to college, some nontraditional students and boomers wish to complete a degree that they once started and never finished (Choy, 2002). Furthermore, community colleges, universities, and other educational institutions often notice an increase in enrollment under a retracting economy (Brownstein, 2001). Graduate attendance also increases with the need for higher education to seek new skills for an existing job or to retool for new employment (Douglas, 2008).

Today’s nontraditional college students must deal with life and family responsibilities, financial challenges and lack cohort support; however, they do have advantages as compared to younger students. Older nontraditional students are often highly motivated to learn compared to their younger traditional college aged counterparts (Benshoff, 1993). This type of increased academic motivation may be attributed to intrinsic motivation, which will be discussed under strengths of nontraditional students in the following section.
Strengths of Nontraditional Students

Intrinsic motivation and deeper learning abilities are well-documented advantages for nontraditional and older students. Several studies found that the biggest advantage for nontraditional college students was that they are more intrinsically motivated in their pursuit of education in contrast to younger traditional students (Benshoff, 1993; Bye, Pushkar, & Conway, 2007; Eppler & Harju, 1997; Justice & Dornan, 2001; Laanan, 1999; Richardson, 1994). Older students were more motivated to acquire knowledge, develop competence in skills, and learn for the sake of learning. These studies have shown that the older college students displayed persistence, autonomy, and pursued the task with self-initiated exploratory strategies. In addition, O’Brien and Merisotis (1996) found that graduate students over age 40 achieved a better GPA compared to younger more traditional students. In another comparison, Hoyert (2009) stated that nontraditional college students (over 25 years old) at the undergraduate level had similar achievement to their younger traditional age (18 to 25 years old) counterparts, despite their additional challenges.

In addition to the aforementioned benefits, older college students have been found to be able to learn and understand with an increased depth compared to their younger counterparts who used a more superficial level of learning (Justice & Dornan, 2001). Justice and Dornan’s study consisted of a self-report survey on metacognition (thinking about how one thinks) and motivation. These researchers were interested in exploring the learning processes of traditional (18-23 years old) and nontraditional college students (24-64 years old). They
measured study skills, motivation, and memory. Results indicated that older nontraditional students were better able to use strategies to increase comprehension, integrate information, and achieved better scores compared to their younger traditional counterparts. Justice and Dornan found that their sample of nontraditional students (24 to 64 years old) often tried to look beyond the surface level to see if there was some deeper meaning, and applied their life experiences to arrive at their conclusions.

Caplan and Schooler (2000) found that older adults were better at using analogy-based learning when applied to text content-based memory retrieval. They studied three age groups: young (20-29 years), middle-aged (30-49 years), and older (50-72 years). Subjects were instructed to read several passages and then answer questions, including an encoding question. Following that, they were given a target passage to read. Upon completion of the readings, the passages were removed and participants were given a target question to answer. The researchers were interested in differences between groups for encoding context of readings and retrieval of the content through use of analogy-based learning.

Their only significant finding was a difference between older adults (50 to 72 years old) and younger adults (20 to 29 years old) in their use of real life (worldly) experiences and analogies to answer the target questions. They also confirmed the recognition and use of analogies which were consistent with the increase in a person’s age and his or her crystallized intelligence. However, in this study, active younger college students were compared with older adults who
were not active in college. The results may have been different if the older adults had been active college students.

**Obstacles for Nontraditional Students**

In contrast to the limited number of strengths identified for nontraditional and older nontraditional college students, more studies demonstrated obstacles for these students in completing their college careers successfully. Several studies showed the main challenges for nontraditional students were coordinating family commitments (being married, single parent, having dependents), and working 35 hours or more along with juggling the required workload for college studies (Benshoff, 1993; Choy, 2002; Kinsella, 1998; Laanan, 1999). This could explain why a majority of older nontraditional college students were enrolled in school on a part-time basis (Choy, 2002; Keith, 2007; Laanan, 1999; Taniguchi & Kaufman, 2005).

Part-time enrollment in college has its disadvantages regarding the completion of a college degree (Choy, 2002; Keith, 2007; Taniguchi & Kaufman 2005). Part-time enrollment usually means spending more years in college. This increases the chances of having one’s college education interrupted with other situations or life obligations. In addition, the lack of financial support such as scholarships, grants, and loans for part-time students makes it difficult to continue in college over prolonged periods (Taniguchi & Kaufman 2005). Taniguchi and Kaufman conducted research using data from the National Longitudinal Survey of Youth, using a probability sample of men and women born from 1957-1964.
Surveys were conducted from 1979 to 2000 and followed the sample group into their 20s, 30s, and 40s.

In this comparison study of full-time verses part-time college students, they concluded that college graduation rates were directly affected by the status of full-time versus part-time enrollment. Their results demonstrated that part-time enrolled students were less likely to obtain a college degree compared to full-time college students. In addition, researchers found that older students took up to 50% longer to complete their studies (Eppler, Carsen-Plentl, & Harju, 2000; Laanan, 1999; O’Brien & Merisotis, 1996). Lastly, an older student may be less likely to pursue a postsecondary education compared to a younger student because remaining work years for an older person will be limited if continuing in a part-time status (Taniguchi & Kaufman, 2005).

Other obstacles nontraditional students face include financial problems and ineligibility for financial aid. Part-time college students are often not eligible to apply for financial assistance such as scholarships, assistantship positions, tuitions waivers, and grants, because full-time enrollment is a common criterion for receiving financial assistance (Taniguchi & Kaufman, 2005). Stone (2008) interviewed 20 nontraditional students who claimed that financial problems were the biggest of their concerns in higher education. Benshoff (1993) found that along with financial commitments (i.e., mortgage payments and supporting family), other conflicts for nontraditional students were being married, single parenthood, and working part or full-time. One restriction resulting from working full-time was that the nontraditional students’ incomes made them ineligible for
financial assistance, and therefore they had to continue to work and had less time for the academic demands of higher education.

There is limited information related to cognitive deficits in nontraditional or older nontraditional students. I will list examples of cognitive declines in older adults to make an inference for older nontraditional college students, therefore, predicting possible cognitive implications for the older nontraditional students over the age of 40.
Chapter 3: Cognitive Implications for Older Students

Cognitive declines accompanying age may place mental challenges upon older nontraditional college students (over 40 years old). This section will cover (a) neural brain changes with age, (b) an experimental study using a fMRI to document decreasing brain activity in older people, (c) information on attention and working memory, and (d) the effects of higher education on memory and that more education is a protection against memory declines.

Neural Brain Changes

Neural brain changes due to aging challenge the older nontraditional college student more than younger nontraditional or traditional aged student. For instance, older students often require more time to complete their studies (O’Brien & Merisotis, 1996). Although at least partly due to their need to work while in school, this slower pace of completing their studies may be due to changes in neural structures related to aging that include a loss of dendrites and dendritic spines, and changes in neurotransmitter receptors and the electrophysiological properties of neurons (Dickstein et al., 2007).

Dickstein et al. (2007) found that as a person ages, neurons undergo a change in the complexity of dendrite arborization and dendritic length. In other words, dendrite arborization and dendrite lengths are decreased or reduced. These short fibers that connect from the cell body of the neuron to another neuron lose their “connection” per se, making it difficult to transmit electrical impulses between neurons. A decrease in other components associated with this process, such as alterations in receptors and loss of dendrites, spines, and myelin may
make it more difficult to continue the use of those particular neural pathways. As these connections lose their functioning, they eventually become ineffective. This can result in memory and encoding deficits. Combined, these multiple changes in the brain may be due to the substrate of age related cognitive function loss (Dickstein et al., 2007).

Neuroscience research has shown that the brain starts to lose density and shrinks in size as early as after age 30. This process is slight at first then gradually increases with age (Papalia, Olds, & Feldman, 2005). This atrophy is due to lost axons, dendrites, and their synapses (Dennis et al., 2008; Lin & Craik, 2008). In contrast, Magnotta et al. (1999) found in their empirical study that significant changes in the brain begin after age 40. This, along with aging and brain maturation, is due to a decrease in the volume of grey matter, a significant change in gyral and sulcal characteristics, and a reduction in cortical thickness. In addition, Sowell et al. (2003) hypothesized that the decline in grey matter density may be associated with the reduction of myelin in different brain areas, causing cell shrinkage. Brain atrophy is more noticeable at or closer to age 50, however, this decline begins at age 40 (Magnotta et al.). Furthermore, Sowell et al. found that grey matter density in the brain starts to progressively decline at age 40. This was concluded after their brain imaging study using fMRI with a sample of 176 normal individuals ranging in age from seven to eighty-seven. In addition, post mortem studies showed that brain weight stays constant until age 40 then starts a gradual reduction.
Early signs of this decay start in the frontal cortex, which is the area of higher or executive cognitive functions. Accompanying this gradual loss of brain matter, there is a slowing of the central nervous system that affects cognition and physical coordination. These difficulties may lead to impairments of basic cognitive functions in the prefrontal cortex (Dennis et al., 2008; Lin & Craik, 2008).

**fMRI Brain Study**

In an experimental study by Dennis et al. (2008), 14 younger adults (8 men and 6 women, mean age of 19.4) and 14 older adults (9 women and 5 men, mean age of 68.4) were scanned with a fMRI (functional magnetic resonance imaging) during an encoding exercise. Researchers found that areas between the hippocampus and the prefrontal region were affected by aging. Subjects were scanned to measure brain activity while encoding faces, scenes, and face-scene pairs. While their brain activity was being measured, participants performed a N-back working memory task. For every image presented to the participant, subjects had to determine if it was presented two images earlier. Dennis et al., concluded that hippocampal activity, in relationship to source memory encoding, was reduced in older adults compared to their younger counterparts. Secondly, the posterior codices were weaker for older adults compared to younger adults. This function is located in the parietal lobe and sends messages to the nervous system enabling a person to initiate motor movement.

The hippocampus is the part of the brain responsible for forming explicit memories. These memories are then transferred to other parts of the brain for
storage. It also plays an important role in long-term memory (Meyers, 2005; Goldstein, 2008). The prefrontal cortex is the area in the frontal lobe of the brain able to handle complex behaviors, such as decision-making. The prefrontal cortex initiates the behavior of accepting or rejecting a decision (Goldstein, 2008). Using the N-back activity as an example, when the subject is presented an image, he or she must decide to accept or reject it depending on whether or not it was shown earlier.

**Attention, Working Memory, and Effect of Higher Education on Memory**

In this last section on cognitive implications for older nontraditional students, some information on attention and working memory is provided to help understand Van Gerven, Meijer, and Jolles’s (2007) experimental study that follows. Lin and Craik (2008), reviewed literature on changes in memory during normal aging and discussed how memory is thought to be broken down into five systems. I will focus on two of these systems, working memory and attentional resources. Working memory is the ability to hold small amounts of information in the span of conscious awareness. Attentional resources might be called a type of mental energy. For instance, an easier mental task will require less mental energy and ones that are more difficult will require more energy. Lin and Craik claim that older adults have greater difficulties with the use of working memory. As a person gets older, it becomes more difficult to hold information in working memory accurately. They also proposed that the amount of attentional resources available for cognitive processing declines with age.
Similarly, Van Gerven, Meijer, and Jolles (2007), concluded that more education does not provide protection against age-related declines of focal attention in working memory. Protection against age-related memory declines is based on new synaptic growth in new areas of the brain due to one’s continued learning (education) process. Focal attention in working memory is a new concept; however, it is similar to attentional resources. Both focal attention and attentional resources refer to the attention to one item. Focal attention is the portion of working memory that is being processed at the time, or being attentive to the item that needs concentration at that particular time.

Their study consisted of two groups of younger (20-30 years) and middle-aged (50-60 years) adults. Van Gerven, Meijer, and Jolles tested attention within working memory for both groups. The participants were presented a series of random items and were asked to recall a previous item after seeing a newer item. The researchers hypothesized that, compared to younger adults, middle-aged adults with additional education had better use of their focal attention in working memory. The results were based on reaction time with middle-aged adults taking longer to submit their answers compared to their younger counterparts. One hypothesis based on these results is that middle-aged adults were not able to protect themselves from declines with focal attention in memory loss through continuing education. Their performance on the task (N-back) was worse than that of younger adults. However, Van Gerven, Meijer, and Jolles also suggested that middle-aged adults may have taken more time in order to increase the accuracy of their answers.
In contrast to the above findings, Lin and Craik (2008) found that with practice, support, and memory training, recall can improve in healthy older adults. For instance, training recollection, such as using strategies like memory aids or creating supportive conditions to trigger memory, can put fewer demands on memory processing and memory recall. However, training recollection usually takes a period of time, and Lin and Craik’s empirical study on recommendations for memory aid were originally targeted toward elderly adults in a rehabilitation program environment as compared to older college students.

**Summary**

The nontraditional college student population has been steadily increasing since the 1970s (Bauman, et al., 2004; Fairchild, 2003; Kinsella, 1998; Neal, 2008; O’Brien & Merisotis, 1996; Taniguchi & Kaufman, 2005). This increasing segment of the college population will require academic institutions to adapt to them and their needs (Belcastro & Purslow, 2006; Benshoff, 1993). Nontraditional students have been found to be different from traditional students in many ways, with unique strengths and limitations as they pursue educational goals (Benshoff, 1993; Bye, Pushkar, & Conway, 2007; Eppler & Harju, 1997; Justice & Dornan, 2001; Laanan, 1999; Richardson, 1994).

The purpose of this study is to determine whether there are differences in age, cognition (encoding, memory, and attention) and intrinsic motivation that can explain differences in GPA among older and younger nontraditional, and traditional students at the undergraduate level.
Chapter 4: Study 1 - Method and Results

Method

I conducted a pilot study with a small population in Fall, 2010 in order to create, test and validate the survey instrument. Pilot participants included 204 students from Leeward Community College and the University of Hawai‘i at Manoā. The number of participants recruited was determined by the number of question items on the original survey instrument. In order to maximize reliability, a decision was made to use a minimum of four to five participants per question item (Gorsuch, 1983). With a 38 item pilot instrument, a minimum sample size of 152 participants was needed.

Participants. Early in the Fall semester of 2010, a preliminary sample of 20 students was recruited to check the clarity of the original 38 draft sample question items intended for the instrument. These 20 students were recruited from the College of Education department in Wist Hall at the University of Hawai‘i Manoā and from students in the Leeward Community College cafeteria.

Following that, 204 students were recruited for a pilot sample from three graduate and two undergraduate classes at the University of Hawai‘i at Manoā and five classes at Leeward Community College. In addition, students were recruited from the University of Hawai‘i at Manoā cafeteria, and Hamilton and Sinclair libraries. All participants were enrolled active college students.

Instrument. A survey instrument was developed consisting of 38 questions including seven items each for encoding, memory, retrieval, and attention for the cognition category, and ten items testing intrinsic motivation.
This self-report survey used a 7-point Likert scale, ranging from one for strongly disagree to seven for strongly agree to measure cognition and motivation levels for all participants.

**Procedure.** The 20 preliminary participants evaluated the survey questions for clarity. All participants were informed that they were to test the clarity and strength of question items to be used in a later study and their participation was voluntary. The principal investigator was present for the larger pilot survey administration at all University of Hawai‘i at Manoā locations and classes. Instructors agreed to administer pilot surveys at the Leeward Community College campus in Pearl City and Wai‘anae. All participants for the larger pilot study (n=204) were voluntary.

**Results**

The survey consisted of 38 questions including seven items each for encoding, memory, retrieval, and attention, and ten items testing intrinsic motivation. The items were examined through VARIMAX rotation. The process was then repeated using principle component analysis PROMAX rotation which showed a low correlation between constructs. The reason for the use of PROMAX was based on the assumption that all cognitive factors may have had a relationship with each other. However, the amount of correlation between factors was too insignificant to consider. Therefore, a decision was made to use the solution from VARIMAX rotation and treat each factor as independent.

The factor analysis (Gorsuch, 1983) demonstrated that several items loaded onto different factors than originally intended. In order to improve
reliability, items were reworded for clearer comprehension and were rearranged into different constructs to improve internal consistencies among the factors. In addition, weaker items were removed from the instrument. The final survey instrument (Appendix B) consisted of 18 items, six encoding, four memory, and four attention as well as four intrinsic motivation questions. The retrieval factor was dropped from the instrument due to poor internal consistency; however two retrieval items loaded on the encoding factor, and were therefore added to that factor. One other retrieval item loaded onto memory and thus was included on that factor.

The intent was to create more than the needed number of items in order to allow deletions of those with poor consistency. The items were based on a formula from a question design used in a previous unpublished study that loaded on relevant factors. Key words were used to represent different aspects of cognition. For instance, learning and understanding were related to encoding. Memorize, recall, and remember were related to memory. These items were then reconfigured, elaborated or removed from the instrument to maximize reliability. The preliminary assigned items were subsequently tested on a 20 student sample at the University of Hawaii Manoa to assess their clarity.

These students identified five questions on the draft instrument as being ambiguous. I reworded those questions or removed the items to improve clarity. For example, the statement “I have difficulty memorizing symbols, e.g. H2O, symbol for aluminum = AL, MSFT=Microsoft” was changed to “I have difficulty memorizing symbols, e.g. AL = aluminum, ☮ = wind/spirit, MSFT = Microsoft,”
σ² = variance, 好日子 = Good day.” The revision was still considered unclear; therefore, the item was removed from the instrument. In another example, the statement, “If I have to, I can concentrate on something even if it is boring” was changed to, “I can pay attention to something even if I am not interested in the subject.”

The following section reports the results from the validation study. The three factors of encoding, memory, and attention explained 53% of the total variance for cognition. The first encoding factor explained 21% of the variability, the second factor for memory explained 16%, and the third factor of attention determined 15% of the variability. Intrinsic motivation was tested using a single factor analysis with Principle Component and explained 57% of the variability. The factor analysis has provided construct validity for this first study. The reliability coefficients of the four scales were also examined. Cronbach’s alpha coefficients were calculated for each of the factors of encoding, memory, attention, and intrinsic motivation and are listed in Table 1. The factor analysis for the factors in cognition is described in Table 2. For this first study, SAS version 9.1.3 was used for the factor analysis and to calculate Cronbach’s alpha.
Table 1

*Cronbach’s Alpha Coefficients of the Scales*

<table>
<thead>
<tr>
<th>Measures</th>
<th>Raw</th>
<th>Standardized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoding</td>
<td>0.771</td>
<td>0.773</td>
</tr>
<tr>
<td>Memory</td>
<td>0.743</td>
<td>0.742</td>
</tr>
<tr>
<td>Attention</td>
<td>0.684</td>
<td>0.689</td>
</tr>
<tr>
<td>Intrinic Motivation</td>
<td>0.744</td>
<td>0.745</td>
</tr>
</tbody>
</table>
Table 2

*Factor Loadings for Encoding, Memory, and Attention with VARIMAX Rotation*

<table>
<thead>
<tr>
<th>Items</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>en1</td>
<td>0.633</td>
<td>0.110</td>
<td>0.011</td>
</tr>
<tr>
<td>en2</td>
<td>0.605</td>
<td>0.063</td>
<td>-0.209</td>
</tr>
<tr>
<td>en3</td>
<td>0.687</td>
<td>0.116</td>
<td>0.155</td>
</tr>
<tr>
<td>en4</td>
<td>0.747</td>
<td>0.066</td>
<td>0.023</td>
</tr>
<tr>
<td>en5r</td>
<td>0.634</td>
<td>0.202</td>
<td>-0.089</td>
</tr>
<tr>
<td>en6r</td>
<td>0.700</td>
<td>0.082</td>
<td>0.281</td>
</tr>
<tr>
<td>me1</td>
<td>0.056</td>
<td>0.838</td>
<td>0.045</td>
</tr>
<tr>
<td>me3</td>
<td>0.187</td>
<td>0.652</td>
<td>0.034</td>
</tr>
<tr>
<td>me5</td>
<td>0.279</td>
<td>0.616</td>
<td>0.090</td>
</tr>
<tr>
<td>me6r</td>
<td>0.008</td>
<td>0.827</td>
<td>0.025</td>
</tr>
<tr>
<td>at1</td>
<td>0.377</td>
<td>0.085</td>
<td>0.589</td>
</tr>
<tr>
<td>at2</td>
<td>-0.157</td>
<td>0.022</td>
<td>0.712</td>
</tr>
<tr>
<td>at5</td>
<td>0.028</td>
<td>0.032</td>
<td>0.724</td>
</tr>
<tr>
<td>at7</td>
<td>0.017</td>
<td>0.063</td>
<td>0.798</td>
</tr>
</tbody>
</table>

Note. Factor 1=Encoding; Factor 2=Memory; Factor 3=Attention.

The criteria for factor loading > .50
Chapter 5: Study 2 - Method and Results

Method

Participants. In the larger study, I recruited 334 participants from the student body at the University of Hawai‘i -West O‘ahu and Leeward Community College campuses. The University of Hawai‘i -West O‘ahu had 1140 students enrolled in 2010. Students’ mean age was 30.6 and 100% of surveyed participants were at the undergraduate college level. The University of Hawai‘i -West O‘ahu is a four-year accredited college and enrolls nontraditional students at the undergraduate level (UH systems, 2010). Leeward Community College had 7484 students in 2010. This community college is a two-year college with a mean age of 24.1 and enrolls nontraditional students at the undergraduate level (UH systems, 2010). All participants in this study were active college undergraduate students.

The sample age range was from 18 to 73 years old. The total sample of 334 students formed three groups of 61% (204) traditional (18 – 24 years old), 22% (73) younger nontraditional students (25 – 39 years old), and 17% (57) older nontraditional college students (40 years and older). The categorization of these groups was based on the literature that brain deterioration starts at age 40 (Magnotta et al., 1999; Papalia, Olds, & Feldman, 2005; Sowell, et al., 2003). The participants came from various ethnicities, income brackets, fields of employment, educational backgrounds, and family arrangements (married, single, with or without children, etc.). Table 3 shows the percentages of each group among schools used in this study.
Table 3

Percentage of Participants in 2011 Study

<table>
<thead>
<tr>
<th>College</th>
<th>Traditional</th>
<th>Younger Nontraditional</th>
<th>Older Nontraditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>University of Hawai‘i West O‘ahu</td>
<td>39%</td>
<td>16%</td>
<td>12%</td>
</tr>
<tr>
<td>Leeward Community College</td>
<td>22%</td>
<td>6%</td>
<td>5%</td>
</tr>
</tbody>
</table>

The University of Hawai‘i -West O‘ahu was chosen as the primary target site because of its high enrollment of nontraditional students over the past several years. The University of Hawai‘i -West O‘ahu has catered to the older college students having other life obligations making traditional college enrollment difficult (J. Mobley, personal communication May 26, 2011). The percentage for enrollment of younger nontraditional (25 years and older) and older nontraditional (over 40 years old) students at the University of Hawai‘i -West O‘ahu for the past several years is listed on Tables 4 and 5.
Table 4

*Enrollment of Nontraditional* Students at University of Hawai‘i –West O‘ahu

<table>
<thead>
<tr>
<th>Semesters</th>
<th>Student percentage enrolled</th>
<th>Number of Students enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2008</td>
<td>62.5%</td>
<td>712</td>
</tr>
<tr>
<td>Spring 2009</td>
<td>54.1%</td>
<td>732</td>
</tr>
<tr>
<td>Fall 2009</td>
<td>59.3%</td>
<td>791</td>
</tr>
<tr>
<td>Spring 2010</td>
<td>58.5%</td>
<td>735</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>57.5%</td>
<td>845</td>
</tr>
<tr>
<td>Spring 2011</td>
<td>57.3%</td>
<td>786</td>
</tr>
</tbody>
</table>

*Note.* *College students > 25 years old (J. Mobley, personal communication June 9, 2011).*

Table 5

*Enrollment of Older Nontraditional** Students at University of Hawai‘i –West O‘ahu*

<table>
<thead>
<tr>
<th>Semesters</th>
<th>Student percentage enrolled</th>
<th>Number of Students enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2008</td>
<td>20.5%</td>
<td>234</td>
</tr>
<tr>
<td>Spring 2009</td>
<td>21.7%</td>
<td>248</td>
</tr>
<tr>
<td>Fall 2009</td>
<td>19.2%</td>
<td>256</td>
</tr>
<tr>
<td>Spring 2010</td>
<td>17.8%</td>
<td>224</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>17.9%</td>
<td>264</td>
</tr>
<tr>
<td>Spring 2011</td>
<td>17.3%</td>
<td>237</td>
</tr>
</tbody>
</table>

*Note.* **College students > 40 years old (J. Mobley, personal communication June 9, 2011).*
Of the 786 younger nontraditional students (over 24 years old) enrolled at the University of Hawai‘i-West O‘ahu in Spring of 2011, 559 students were enrolled online of which 164 were older nontraditional students (over 40 years old). However, this does not mean all classes were online; rather one or more of students’ classes were classified as online (J. Mobley, personal communication May 26, 2011).

**Instrument.** A self-report survey consisting of 18 items using a 7-point Likert scale, ranging from 1 for strongly disagree to 7 for strongly agree was given to all participants. Items were designed to measure three cognitive traits (encoding, memory, and attention) and intrinsic motivation. The survey also included questions asking demographic information such as age, gender, and self-reported grades (and classes) from the previous semester (Fall 2010). GPA was calculated for each individual student using their self-reported grades and a grade conversion scale from the University of Hawai‘i Manoā (UH systems, 2010).

**Procedure.** Prior to administering the survey, all participants were informed of their rights as research subjects. Participants were informed that the study was completely voluntary, and their responses would remain anonymous. Subjects were informed that the survey had no right or wrong answers and would take about 4-5 minutes, and that they could end their participation at any time if they felt uncomfortable.

Recruitment was obtained through permission from prearranged classes and by approaching other willing participants in and outside of classes on campus. Participants were recruited in 11 classes with instructors’ approval at the University of Hawai‘i-West O‘ahu, seven classes at Leeward Community College, the computer lab at both locations, and the library at Leeward Community College. Students were recruited based on their
willingness to participate. The principal investigator was present in all classes at the University of Hawai‘i -West O‘ahu to administer surveys. Instructors at Leeward Community College administered all surveys in their own classrooms. In appreciation for participating in the survey, snack treats were distributed to all participants.

**Data analysis**

In this study, a multiple regression model was proposed using the possible predictors of age, encoding, memory, attention and intrinsic motivation to determine GPA for undergraduate college students. The GPA for each participant was calculated using the University of Hawai‘i’s grading scale for each individual student (UH systems, 2010). In addition, I used college status (traditional 24 years or less, younger nontraditional 25 to 40 years old, and older nontraditional 40+ years old), instead of the “age” category for a better fit with the regression model. The criteria of Cook’s D and Standardized residual determined 15 outliers to be removed from the data set. In addition, 13 survey instruments were removed due to improper completion, such as using only one rating number through their entire survey. These adjustments resulted in the sample size of 306 in the final data set.

A factor analysis was conducted to confirm the best possible item selection for analysis coinciding with the target sample groups’ question responses to the survey. The final selection included a total of twelve items, three items each for encoding, memory, attention, and intrinsic motivation. The items of encoding, memory and attention explained 70% of the total variance for cognition for encoding, memory, and attention. The first factor of encoding explained 33% of variability, the second factor of memory explained 22%, and the third factor of attention determined 14% of the variability.
Intrinsic motivation on a single factor analysis with Principle Component explained 73% of the variability. This factor analysis has provided construct validity for Study Two.

SPSS versions 17 and 18 were used for the analysis of this data to determine descriptive statistics, correlation, analysis of variance (ANOVA), coefficients and factor analysis. Table 6 lists the results of the factor analysis for all cognition items of encoding, memory, and attention.

Table 6

*Factor Loadings for Encoding, Memory, and Attention with VARIMAX Rotation*

<table>
<thead>
<tr>
<th>Items</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>en6r</td>
<td>.817</td>
<td>.207</td>
<td>.045</td>
</tr>
<tr>
<td>en4</td>
<td>.808</td>
<td>.058</td>
<td>.029</td>
</tr>
<tr>
<td>en1</td>
<td>.766</td>
<td>.247</td>
<td>.091</td>
</tr>
<tr>
<td>me1</td>
<td>.176</td>
<td>.918</td>
<td>-.027</td>
</tr>
<tr>
<td>me6</td>
<td>.098</td>
<td>.900</td>
<td>.013</td>
</tr>
<tr>
<td>me5</td>
<td>.234</td>
<td>.708</td>
<td>.030</td>
</tr>
<tr>
<td>at7</td>
<td>-.094</td>
<td>.080</td>
<td>.857</td>
</tr>
<tr>
<td>at2</td>
<td>.063</td>
<td>.076</td>
<td>.824</td>
</tr>
<tr>
<td>at5</td>
<td>.042</td>
<td>-.001</td>
<td>.757</td>
</tr>
</tbody>
</table>

Note. Factor 1=Encoding; Factor 2=Memory; Factor 3=Attention.

The criteria for factor loading > .50
Results

Descriptive statistics identified younger nontraditional (25 to 40 years old) college students’ reported mean GPA as the highest at 3.388, older nontraditional (40+ years old) mean GPA was second at 3.203, and traditional (24 years old and less) college students’ mean GPA was the lowest at 3.117. The mean scores for encoding, memory, attention, and intrinsic motivation are listed in Table 7 as well as the standard deviations for all predictors.

Table 7
Descriptive Statistics for Students’ GPA and Predictors

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional GPA</td>
<td>3.117</td>
<td>.694</td>
</tr>
<tr>
<td>Younger Nontraditional GPA</td>
<td>3.388</td>
<td>.572</td>
</tr>
<tr>
<td>Older Nontraditional GPA</td>
<td>3.203</td>
<td>.503</td>
</tr>
<tr>
<td>Encoding</td>
<td>4.323</td>
<td>1.155</td>
</tr>
<tr>
<td>Memory</td>
<td>4.031</td>
<td>1.415</td>
</tr>
<tr>
<td>Attention</td>
<td>3.161</td>
<td>1.298</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>5.075</td>
<td>1.208</td>
</tr>
</tbody>
</table>

Correlation analysis demonstrated that independent variables did not correlate highly to each other and there were no significant relationships between independent variables and the dependent variable. Nineteen of the twenty-eight correlations were statistically significant with some of the highest correlations between GPA and intrinsic motivation (.381), intrinsic motivation and older nontraditional students (.227), nontraditional students and intrinsic motivation (.189), and a high negative correlation between traditional college students and intrinsic motivation (-.337). Interestingly, there
was a high negative correlation between encoding and older nontraditional students (\-0.276) and memory and older nontraditional college students (\-0.279). In contrast, traditional college students had a higher correlation with encode (0.171) and an even higher correlation with memory (0.272). Younger nontraditional college students had a high correlation with GPA (0.167). All the above correlations were significant at the .01 level. In addition, traditional college students had a negative correlation with GPA (\-0.145) and older nontraditional students had a high correlation with attention (0.114). These two correlations were significant at the .05 level. Pearson’s correlations are listed in Table 8.

Table 8

Pearson’s Correlation Coefficients among the Dependent Variable and Predictors

<table>
<thead>
<tr>
<th></th>
<th>GPA</th>
<th>ON</th>
<th>NT</th>
<th>Tra</th>
<th>Eavg</th>
<th>Mavg</th>
<th>Aavg</th>
<th>Iavg</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ON</td>
<td>0.004</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NT</td>
<td>0.167*</td>
<td>0.247**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tra</td>
<td>0.112*</td>
<td>0.276**</td>
<td>0.050</td>
<td>0.171**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eavg</td>
<td>0.054</td>
<td>0.279**</td>
<td>0.066</td>
<td>0.272**</td>
<td>0.392**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mavg</td>
<td>0.024</td>
<td>0.114*</td>
<td>0.031</td>
<td>0.115*</td>
<td>0.121*</td>
<td>0.001</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Aavg</td>
<td>0.381**</td>
<td>0.227**</td>
<td>0.189**</td>
<td>-0.337**</td>
<td>0.143*</td>
<td>0.072</td>
<td>-0.051</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. *p< .05; **p<.01

ON=Older Nontraditional Students, NT=Nontraditional Students, Tra=Traditional Students, Eavg=Encoding Average, Mavg=Memory Average, Aavg=Attention Average, Iavg=Intrinsic Motivation Average
The results of the regression model showed that the predictors for students’ status, encoding, memory, attention and intrinsic motivation significantly predicted GPA for college students at the undergraduate level (Table 9). The overall model explained 16% of the variance in undergraduate students’ GPA. The adjusted $R^2$ was .143, which takes into account the sample size and significance of the predictors. Five predictors explained 14% of the variance for undergraduate college students’ GPA. The overall F-test is significant at the $\alpha = .001$, $F(6, 299) = 9.467$, $p = .000$, as shown in Table 9. This suggests that one or more predictors influenced GPA for college students at the undergraduate level. The original regression model is as follows: GPA = Status (age) + Encoding + Memory + Intrinsic Motivation

Table 9

<table>
<thead>
<tr>
<th>Model</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>20.307</td>
<td>6</td>
<td>3.385</td>
<td>9.467**</td>
<td>.000</td>
</tr>
<tr>
<td>Residual</td>
<td>106.891</td>
<td>299</td>
<td>.357</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>127.198</td>
<td>305</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. $p<.05$; **$p<.01$

The coefficient table for the regression model showed there were four insignificant predictors: (a) college status (traditional 24 years or less, younger nontraditional 25 to 40, and older nontraditional 40+ years old), (b) encoding, (c) memory, and (d) attention ($p > .05$) on the dependent variable. Intrinsic motivation was the only predictor to affect GPA for undergraduate college students ($p < .001$) as listed on
Table 10. Therefore, the final model can include only intrinsic motivation to predict GPA for college students at the undergraduate level.

Table 10

*Estimated Regression Coefficients*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
</tr>
<tr>
<td>constant</td>
<td>2.080</td>
<td>.207</td>
<td></td>
</tr>
<tr>
<td>ONT vs T</td>
<td>.086</td>
<td>.109</td>
<td>-.045</td>
</tr>
<tr>
<td>YNT vs T</td>
<td>.271</td>
<td>.090</td>
<td>.084</td>
</tr>
<tr>
<td>Eavg</td>
<td>.024</td>
<td>.034</td>
<td>.043</td>
</tr>
<tr>
<td>Mavg</td>
<td>.002</td>
<td>.027</td>
<td>.003</td>
</tr>
<tr>
<td>Aavg</td>
<td>-.004</td>
<td>.027</td>
<td>-.008</td>
</tr>
<tr>
<td>Iavg</td>
<td>.197</td>
<td>.032</td>
<td>.369</td>
</tr>
</tbody>
</table>

*Note.* ONT=Older Nontraditional Students (40+ years), YNT=Nontraditional Students (25-40 years), T=Traditional Students (24 years and less), Eavg=Encoding Average, Mavg=Memory Average, Aavg=Attention Average, Iavg=Intrinsic Motivation Average.

The final prediction equation for the regression model is as follows: GPA = 2.080 + .197 (Iavg) + .024 (Eavg) + .002 (Mavg) - .004 (Avg) + .130 (NT) - .077 (ON). The estimated intercept of the regression equation is 2.080 when the expected GPA is constant. This means that when intrinsic motivation increases one unit, the students’ GPA will increase by an average of .197 units (See Table 10).
Conclusion

Prior studies on nontraditional college students found that they have higher intrinsic motivation and achieved a higher GPA compared to their younger counterparts. Current literature also suggests that there are cognitive deficits associated with age that may affect encoding, memory, and attention functions. This study explored the possible impact of students’ age (status), encoding capabilities, memory, attention span, and intrinsic motivation on their grade point average at the undergraduate level. The results indicate that students’ age or college status (traditional 24 years or less, younger nontraditional 25 to 40 years old, and older nontraditional over 40 years old), did not predict their GPA. In addition, college students’ cognition (encoding, memory, and attention) capabilities did not significantly impact their GPA. This study found that, of the factors studied, only intrinsic motivation contributed to predicting GPA for college students at the undergraduate level.

Implications

Implications for College students. Evidence suggests that intrinsic motivation is an important factor in determining college students’ GPA. Students considering enrolling in or attending college should assess their own intrinsic motivation before entering college in order to predict their success. Without an adequate desire to be educated or succeed in college, a student is at a disadvantage compared to students with more intrinsic motivation. Although there are other factors that could lead to improved GPA not mentioned in this paper, it would be suggested, that the student find or create their own intrinsic motivation before entering college. In addition, the student should acquire a strong interest or passion toward their field of study in order to enhance their intrinsic
motivation. This would improve their chances of academic success or attaining a higher GPA while attending college.

**Implications for Educators.** Results from this study argue that with more intrinsic motivation, students can achieve higher GPAs. If educators can create techniques or conditions to increase or stimulate students’ intrinsic motivation towards learning, they may be able to help students be more academically successful. Since intrinsic motivation is different for each individual student, this may be a difficult task for the educator. However, because intrinsic motivation is one key factor for the prediction of students’ GPA, more research is needed to identify opportunities to increase this phenomenon. These may include relating academic topics to the students’ own cultures or culture of their cohort. For example, instructors could reference subject topics to the concepts related to student cohorts such as “The Tech-bubble, 9-11 (War on terror), or reality TV.” Overall, the educator’s responsibility may be more than just to instruct or provide knowledge, but to also help to bring forth underlying motivations towards the student’s academic success. Therefore, the challenges for the instructor may lie beyond the creativity for an interesting lesson plan filled with the maximum amount of relevant knowledge. Educators may have to ask the question, “Why are students really motivated to be in school?”
Discussion

This thesis consisted of two independent studies. The first study was the pilot, which recruited two separate samples to create and test the reliability for the survey instrument. The pilot study underwent a series tests to insure comprehension of instrument items. A factor analysis confirmed the validity and reliability. The second study was conducted recruiting a larger sample to examine the effects of age, cognition (encoding, memory, and attention), and intrinsic motivation on GPA for undergraduate college students. A factor analysis was conducted to select the best possible items for the target group being studied. The current study concluded intrinsic motivation to be the primary predictor for GPA amongst undergraduate college students. Evidence suggests that the college student’s amount of intrinsic motivation will predict their GPA level. This has been my contribution towards the further study on older nontraditional, younger nontraditional and traditional college students in relationship to their GPA, age, cognition and intrinsic motivation.

The existing literature suggests that there are cognitive declines associated with age and that older college students achieve better GPA than their younger counter parts. Although, this study found that age and cognitive abilities of encoding, memory, and attention have no significant impact on GPA, the correlation coefficient (Table 8) reported an interesting finding. Nontraditional college students’ (25 to 40 years older) GPA was significantly higher compared to traditional students. This would suggest that nontraditional students (25 to 40 years old) have the greatest chance of academic success over traditional college students. In addition, this implies the years between 25 and 40 are the prime years for a college education in relationship to successful GPA levels. This
is in contrast to the literature that older college students achieve higher GPA, which suggests that there is a certain time frame to achieve peak academic performance between the years of 25 to 40 years old. Furthermore, traditional college students had a negative correlation. This would imply as a college student’s age decreases, GPA would have a parallel effect. This may explain why some traditional college students are not ready for college or fail to achieve academic success.

There was a high correlation between GPA and intrinsic motivation. This would suggest that the amount of intrinsic motivation is directly related to GPA status. Older nontraditional (over 40 years old) had the highest motivation, nontraditional (25 to 40 years old) were next, and traditional college students (24 years and less) had a significantly low correlation. These figures propose that intrinsic motivation increases with age and decreases in a parallel fashion. The ascending correlation of GPA is congruent with current literature in comparison with nontraditional students (over 25 years old) and traditional college students 18 to 25 years old (Hoyert, 2009).

Another interesting finding was that encoding and older nontraditional college students had a significant negative correlation. This suggests that as the student age increases there is a decline in the ability to encode information. Furthermore, memory and older nontraditional college students also had a significant negative correlation. This would also imply there is a decrease in memory capacity correlating to the increasing age of the student. This evidence coincides with the existing literature of cognitive deficits resulting from brain changes as adults age (Dennis et al., 2008; Dickstein et al., 2007; Lin & Craik, 2008; Magnotta et al., 1999; Sowell, et al., 2003). In contrast, traditional aged college students had a high correlation to encode and even higher for memory ability.
This might offer the possibilities that younger college students are better at encoding and memorizing information. However, because of their significantly low correlation to intrinsic motivation, some traditional college students may be uninterested to attain a higher GPA or academic success. Unfortunately, there is no conclusive data to support the above assumptions. On the other hand, evidence from the current study suggests these possibilities; therefore, further study is needed on this phenomenon.

Overall, the current study argues that age or cognition did not have a significant impact for determining one’s GPA as this study was originally intended and compared to the literature review. However, evidence now suggests that academic accomplishment can be achieved at any age accompanied with the adequate amount of intrinsic motivation. In addition, cognitive ability had no effect on GPA at any age. This would also support the current evidence that with adequate intrinsic motivation the student can attain academic success, if they have the desire to do so.

**Limitations**

Subjectivity was probably the main limitation in this study. In other words, the students’ responses to survey questions were based on their personal opinions rather than objective data. In some cases, students may have responded to the survey inaccurately based on their perceptions to the social norm. For example, participants may have selected an answer that they thought would be a preferred response. Another limitation may have resulted from participants being apathetic in completing their survey responses, therefore, varying answer accuracy. For example, the survey questions are on a rating scale from one, strongly disagree to seven strongly agree. There were a few surveys (eliminated from the analysis) that were marked with “fours” on the entire instrument. I
conclude that these participants were uninterested in completing the survey properly. This particular problem was evident in the pilot study and the final survey administration at the community college level responses.

Secondly, the target sample size (older nontraditional students over 40 years old) may have been too small compared to other student categories, possibly diluting the final results. This may be due to a large percentage of older students taking online classes at University of Hawai‘i -West O‘ahu (J. Mobley, personal communication May 26, 2011), therefore, having the remaining pool of this group of students smaller than I intended for recruitment.

Furthermore, it may be possible that certain instrument items may have been unclear to certain participants. The creation of the survey instrument underwent several steps and was tested to ensure the clarity and comprehensiveness of each item. However, the possibility of ambiguous interpretation of question items by participants cannot be ruled out.

Lastly, GPA may not be comparable amongst students in different colleges as well as between educational departments. Students’ aptitude may vary when comparing different courses which may also require different academic skills. For instance, a student studying math may use a different set of skills compared to some in a composition class. There may also be different standards when comparing between colleges, for instance, a comparison between a community college and four-year University.
Direction for Future Research

This study examined several possible predictors for college students’ GPAs at the undergraduate level. However, there are other factors that could have affected GPA that were not explored in the current study such as amount of study time, number of courses taken, instructional methods, SES, and full or part-time employment just to name a few. What determines one’s GPA can be complex and broad. It may involve any number of possible factor combinations. Roles of these other possibilities should be considered in future research. More study is required to understand these multiple factors and their combinations which may have an effect on GPA and Intrinsic Motivation.

Future studies should use more homogenous populations. For example, students at four-year universities may provide different results as compared to a population from a community college, and results may be stronger if these populations are not mixed. In addition, consideration should be given when comparing different schools, because of possible differences in academic proficiencies among students. Similar concerns should be accounted for when comparing different academic courses in between different departments.

This study has been a contribution to the existing literature on traditional (24 years and less), younger nontraditional (25 to 40 years old) and older nontraditional college students (over 40 years old) in reference to their GPA, cognition, and intrinsic motivation.
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3.


Appendix A

Figure 1
Figure 1. Percentage of undergraduates with nontraditional characteristics

This graph shows the percentage of nontraditional students per category from 1992-93 and 1999-2000. From U.S. Department of Education, NICES. National Postsecondary Student Aid Study NPSAS: 2000, p.4.
Appendix B

Survey Instrument
Survey

Please DO NOT WRITE YOUR NAME ON THIS SURVEY. This survey is being administered for a thesis study for the department of Educational Psychology at the University of Hawaii at Manoa. The results of this survey will be used to analyze study attributes among different college aged students. All information will be anonymous and kept completely confidential. The survey is voluntary and should take about 4-5 minutes to complete.

Please provide the information for questions listed below

1. Please indicate your gender
   a. Male ______
   b. Female ______

2. What is your age? ________

3. Please list (neatly) all your letter grades and classes from last semester (Fall 2010), (for example: Math B-, History A-, Psychology C, and Biology D+).
   ________________________________________________________________
   ________________________________________________________________

Please (circle your) answer for each statement as to how strongly you agree or disagree with each statement.

1) After listening to a lecture, I can remember most of the key concepts.
   Strongly Disagree Strongly Agree
   1 2 3 4 5 6 7

2) My attention tends to wander after reading a textbook for 15 minutes.
   Strongly Disagree Strongly Agree
   1 2 3 4 5 6 7

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3) I can memorize dates and times without much difficulty.  
Strongly Disagree  
1 2 3 4 5  
Strongly Agree  
6 7

4) I see the value of knowledge over a high grade.  
Strongly Disagree  
1 2 3 4 5  
6 7

5) I typically relate new information to what I already know to help me remember.  
Strongly Disagree  
1 2 3 4 5  
6 7

6) I do not lose my attention or focus when listening to a lecture.  
Strongly Disagree  
1 2 3 4 5  
6 7

7) I can memorize a seven-digit phone number after hearing it once  
Strongly Disagree  
1 2 3 4 5  
6 7

8) I am in school to enrich my understanding of the world.  
Strongly Disagree  
1 2 3 4 5  
6 7

9) I can often read the course material once and remember the main ideas.  
Strongly Disagree  
1 2 3 4 5  
6 7

10) My mind usually wanders at least 3 times in a lecture period.  
Strongly Disagree  
1 2 3 4 5  
6 7

11) Whenever I see a person I have already met I can always recall their name.  
Strongly Disagree  
1 2 3 4 5  
6 7
12) I attend school because I love to learn new things.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

13) I try to understand the concept first, when learning a math formula.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

14) I believe education will make me a better person overall.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

15) When someone shows me how to do a certain task, I can recall the procedure
    and recreate the task.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

16) I can memorize a person’s name after just one introduction or hearing the
    person’s name once.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

17) My mind tends to wander when reading a textbook after 25 minutes.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

18) I can recall the principal points (main concepts) of a lecture four days later.
   Strongly Disagree 1 2 3 4 5 6 7
   Strongly Agree

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