

*A Decade of Achievement
A Celebration of Excellence*



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I am proud to present volume 10 of the **Journal of Research Reports**, “*A Decade of Achievement, A Celebration of Excellence.*” The articles featured in this journal represent the work of the Program participants from the 2004-2005-grant year. As one reads through these articles, it is clear that the breadth of research interests is as diverse as the students that we serve and the quality is outstanding as well. My staff and I could not be more pleased with the efforts that went into producing this meaningful and scholarly body of works.

The Program could not achieve such great accomplishments without the support of the University faculty, staff and administrators who have mentored students over the past ten years. These mentors have not only guided the McNair Scholars in completing their research projects, but they have inspired them to unimaginable heights. All of the research mentors are to be applauded for their efforts in making undergraduate research a reality for the students in this Program.

Within this journal we will showcase the works of seventeen students. Fifteen of these students are McNair Scholars on the campus of Wichita State University and the other two are visiting students from Truman State University in Kirksville, MO. They are participants of the EPSCoR Summer Research Program hosted on the campus of WSU and sponsored by the National Science Foundation.

A special word of thanks is directed to our Research Coordinator, **Ms. Jan Petersen**. Her dedication to the Program and keen ability to motivate the students to produce the best possible document is greatly appreciated. Appreciation is also given to our Writing Tutor, **Ms. Emily Christinat**, Program Counselor, **Ms. Shukura Bakari-Cozart**, and the Senior Administrative Assistant, **Ms. Sheri Daniel** who without their support and persistence in making sure that things get done in a timely manner, none of this would be possible year after year. These individuals are invaluable and irreplaceable. Dedication and commitment are rare qualities and I feel fortunate to have found staff members who hold such qualities.

Finally, I would like to congratulate the students for going beyond the classroom and putting their research interests into practice. Their efforts will not go unnoticed and will prove to be something they can be proud of for many years to come. We are most proud of our students and their accomplishments. This is a well-deserved accomplishment. These students are our future educators and the epitome of “Achievement and Excellence.” Thank you for the opportunity to work with such fine students.

LaWanda Holt-Fields, *Director*



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The Long Term Impact of Participation in an Assessment Based Exercise Program for Older Adults

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Abstract

With the number of older adults growing and becoming a large segment of the population, it has become increasingly important to find ways to improve and/or maintain their quality of life. The current study examines the effects of exercise and quality of life on residents of a Midwestern retirement community. The data was collected over 9 years from 135 residents (mean age of 90.0) who were classified as Regular Exercisers or Non-Exercisers. Results show that the Regular Exercisers experienced a shorter morbidity time and a longer period of independence. Given the differences found between the two groups, implications for interventions such as fitness programs to maintain independent living activities for as long as possible are discussed.

Long Term Impact of Participation in an Assessment Based Exercise Program for Older Adults

Many have and many continue to seek and search for the secrets of longevity. Hollywood has put many scenarios onto the silver screen such as Indiana Jones' Search for the Holy Grail (the Cup of Life) which glamorizes the quest for eternal life (Wikipedia). Movies like *Indiana Jones and the Last Crusade* allow us to indulge in our dreams of the exotic and unimaginable regarding the topic of immortality. Although the nonconforming ways and methods to reach prolonged existence from far away places are often deemed superior, looking at some basic life changes like physical activity may be a better starting point for the improvement of one's life.

Since the 1970's a study of Centenarians has been underway in Okinawa, Japan. The Okinawa Centenarian Study objective is to discover the responsible genetic and lifestyle factors of this aging phenomenon for the health benefit of all. Over 600 Centenarians and a significant amount of 70 - 90 year olds were examined. Their way of life includes eating a low-calorie, unrefined-complex carbohydrate diet and practicing calorie control in a cultural habit known as 'hara hachi bu,' which involves only eating until 80% full. In addition, keeping naturally physically active by gardening, doing martial arts, and participating in the family business helps the Centenarians to maintain their weight. Quite the opposite is the case with middle-

aged Okinawans (age 50) who have a less traditional lifestyle which has made them similar to people from Western society especially with regard to health risks (Okinawaprogram, 1976).

Since the impact of the increasingly aging population will have such a profound effect economically, sociologically and physically, it becomes more and more important to provide advice to increase the quality of life. It is estimated that by 2030 the population of older Americans will double, making one in five Americans older than 65 (US Census Bureau, 2002). Unfortunately, obesity, diabetes, heart disease and other chronic illnesses among middle-aged Americans is steadily increasing, indicating poorer health for many older adults (U.S. Department of Health and Human Services, 2000, 2001). At this time, this population group takes almost one third of the nation's healthcare bill (CDC, 2002) which by itself is an alarming fact.

Exercise has an important role in the relation to the reduction of risk factors and prevention of falls and injuries (Skelton & Beyer, 2003). Each year, a third of the people 65 years and older and about 50 percent of individuals 80 years and older fall (Feder, Cryer, Donovan, Carter, 2000). These falls can have devastating effects on the individuals independence and quality of life that often includes a fear of falling, decreased activity which leads to a functional deterioration, social isolation, depression, a reduction in the quality of life, possible institutionalization and death (Gregg, Pereira, Caspersen, 2000; Lord, Sherrington, Menz, 2000). Often, after a fall there is a period of a "long lie": some may experience this due to shock or injury but many are not able to rise because of a simple lack of fitness causing an infinite number of complications (Skelton & Dinan, 1999).

Depression is projected to be the leading cause of disease burden by the year 2020 (Goodwin, 2003) and it is already a major contributor to health costs. Depression has been linked to doubling hospital days (Apeldorf & Alexopoulos, 2003). Depression causes increased health costs, decreased physical functioning and is associated with worse outcomes after acute medical events (Crystal, Sambamoorthi, Walkup, & Akincigil, 2002). Exercise as a treatment for depression in elders has shown to be beneficial all around. On the other hand, a sedentary lifestyle may have enormous costs to not only them but to society.

In 2001, the total health care cost was an astounding \$1.4 trillion (Healthierus 2004) much of which could have been prevented or lessened through increases in physical activity.

Since the nineties, diseases like cancer, hypertension, heart disease, diabetes, Parkinsons disease, Alzheimers disease, depression, arthritis and a host of others have been combated by 370 newly developed medications from US pharmaceutical companies. According to the Pharmaceutical Research and Manufacturers of America (PHRMA), which represents the country's leading pharmaceutical research and biotechnology companies devoted to inventing medicines, prescription drugs are saving lives, reducing pain and suffering, keeping people out of hospitals and nursing homes, and reducing other forms of health care spending. Although the rise in utilization, the cost of drugs continues to be approximately 10 cents of the nation's health care dollar. However, this can be viewed as treating the symptoms and keeping people moving at an economic cost. On the other hand, when returning back to basics and making some simple adjustments and changes in one's life like physical activity and caloric intake, one can often deter from taking many medications and thus avoid its cost. This study hypothesizes that people who regularly exercise compress morbidity time and have a longer, higher quality of life than people who remain sedative.

Method

Participants

With the introduction of a compulsory assessment as of July 1, 1995, for all new residents, 217 potential participants were screened and 135 of them met the criteria for the study. These 135 qualified residents had no identifiable risk of needing long-term care and qualified for Life Care. Life Care is a plan purchased upon qualification which allows potential residents nursing home admission (HCC), on physician's orders when necessary. The cost of nursing care will vary depending on the purchased plan, and which helps deter against the ubiquitous inflation of nursing home costs.

Participants were divided into two groups: Regular Exercisers (RE) and No Exercisers (NE). The RE group consisted of 75 residents who participated regularly in the annual Functional Fitness Assessment



(FFA) and follow-up counseling. At the time of this analysis, 39 had passed away, reaching an average age of 90.7 years (SD = 6.0). They had lived an average of 9.1 years at a Midwestern Continuing Care Retirement Community (CCRC). The remaining participants averaged 90.0 years of age (SD = 3.9 years). This group exercised on average about three times per week through a recommended exercise program specifically designed to promote functional independence. In addition, this group had acceptable scores on the Mini Mental State exam (MMSE) and the Geriatric Depression Scale (GDS).

The NE group included 60 residents who never or seldom participated in the FFA and follow-up counseling. The participants of this group infrequently, if ever, exercised nor did they follow a recommended program. Of this group, 40 participants had passed away at the time of analysis, reaching an average age of 90.6 years (SD = 4.5 years). They were CCRC residents for an average of 9.2 years. The remaining participants of this group averaged 88.8 years of age (SD = 3.9 years).

Materials

The HLR is an internet-based, systematic functional assessment for older adult populations. Part of the HLR assessment is the Functional Fitness assessment (FFA) which is a series of exercises and surveys that evaluate a person's functional physical ability and mental state. The assessments used from the HLR are intended for the appropriate placement of incoming residents and their immediate and possible foreseeable needs. Furthermore, the assessments are used to evaluate residents on an annual basis and includes exercise such as the timed 8-foot up and go, fall efficacy scale, Physical Performance Battery, Grip Strength, Activities of Daily Living (ADL) and Instrumental ADL (IADL) (HLR, 2005).

Timed 8-Foot Up and Go

For the 8-foot up and go exercise, the participant was instructed to get up from a chair, walk around a traffic cone, return to the chair and sit down. Total time to complete this activity was recorded in seconds.

Fear of Falling

The fall efficacy scale assessment (Tinetti, 1988) evaluated the participant's confidence in performing certain activities without falling. Participants rated

their confidence for 10 activities on a scale from 1 – 10 (1=not confident, 10=very confident). A score of 100 indicates a very safe risk while a score of 0 is a very high risk.

Physical Performance Battery

The Physical Performance Battery (Guralnik, 2000) assessment consisted of the exercises standing, walking and chair stand. The total score of these exercises was captured in the parameter total performance. The standing exercise assessed the lower body strength by measuring how long (max. 10 seconds) the participant could stand with feet Side by Side (SBS), in Semi-Tandem Stand (STS) and in Full-Tandem Stand (FTS). For the walking exercise, the participants were asked to walk a distance of 6 feet at normal speed and then turn a full 360 degrees. The duration of the walk was timed, as well as any observations on walking (deviating from path, marked trunk sway, using assistive device) and turning (unsteady, grabbing support, staggering). For the chair stand exercise, the participants were placed in an armless chair with a straight back against the wall. With their hands folded over their chest, they were asked to stand up five times as quickly as possible. The time from the initial sitting position to the final standing position at the end of the fifth stand was recorded.

Grip Strength

The grip strength assessment measured the participant's grip pressure using a dynamometer. Three tests were conducted on each hand and the grip strength was recorded in kilograms.

Activities of Daily Living (ADL)

The assessments for ADL (Katz, 1970) consisted of a questionnaire about the ability to independently perform regular daily activities related to personal care. The questions assessed any required assistance for bathing, dressing, using the toilet, getting out of bed, bladder and bowel incontinence and eating.

Instrumental Activities of Daily Living (IADL)

The IADL assessment (Lawton, 1980) also consisted of questions focused on daily activities for independent living. The questions evaluated if the participant could do these activities without any help, with some help or not at all. The addressed activities were using the telephone, getting to places

out of walking distance, shopping for groceries or clothes, preparing meals, doing housework, taking medications and handling money.

Design

In this study the independent variable was the presence or absence of an exercise program. To measure the impact of exercise on longevity and quality of life the following dependent variables were examined:

1. Total days in the CRCC Health Care Center (HCC).
2. Total days of last HCC visit.
3. Total number of HCC admissions.

Procedure

All the data from this nine year program was entered into a central facility database and analyzed with SPSS12.00.

Results

Table 1 presents the descriptive analysis for all existing participants at CCRC. The results indicate that the deceased persons were a resident for 9.1 years on average when belonging to the RE group and for 9.2 years when belonging to the NE group. The average age for both living and deceased residents was about the same between people in the RE and NE groups (90.0, 88.6, respectively).

Table 2 presents data that links the effect of exercise with assisted living in the HCC. For both the RE and NE groups, the table shows the total number of days each group spent on average at the HCC 97.7; days vs. 347.3 days, the total days during their last HCC visit, 87.2 vs. 315.9, and the number of HCC admissions, .91 vs. 1.55. The number of days at the HCC, both the total number and during their last visit, was significantly lower for the RE group than for the NE group. Results of the independent samples T-test showed significant differences between the regular exercisers and non-exercisers in the number of days of their last HCC visit ($t(79.67) = -3.77, p < .01$), the total number of days at the HCC ($t(80.67) = -4.11, p < .01$) and the total number of HCC admittance ($t(94.07) = -2.70, p < .01$). However, the standard deviations indicate a wide range of variability in each group (see Figures 1-3).

In Table 3, the RE and NE group are subdivided into deceased residents, residents who lived at the

HCC at the time of data analysis, and those who lived independently. For each subgroup the data is displayed for the total number of HCC days, the total days of the last visit and the total number of HCC admissions. When comparing the results for those who were deceased, the data reveals that the NE group had a considerably greater number of HCC days (454 vs. 151), a higher total number of HCC days (330 vs. 133) and also a higher number of HCC admissions (1.78, vs. 1.26). Similar results are obtained when comparing those who are still living in the HCC; the NE group has a higher number of HCC days (669 vs. 158), higher number of days at their last HCC visit (623 vs. 146) and higher number of admissions (2.11 vs. 1.57).

Table 1. Descriptive Analysis

Group	N	#Years @ CCRC Before Death	Avg. Age
RE	75		
Dead	39	9.1	90.7 (6.0)
Living	36		90.0 (3.9)
NE	60		
Dead	40	9.2	90.6 (4.5)
Living	20	9.2	88.6 (4.3)

Table 2. Health Care Data by Activity Level

Group	N	#Total # days @ HCC	Total days @ Last Visit	Total # HCC Admissions
RE	75	97.7 (208.1)	87.2 (203.3)	.91 (1.0)
NE	60	347.3 (432.5)	315.9 (432.9)	1.55 (1.6)

Table 3. Health Care Center Data by Activity Level (Living and Non-Living)

Group	N	Total HCC Days	Total days Last Visit	Total # Admissions
RE	75	97.7 (208.1)	87 (203.3)	.91 (1.0)
Died	39	151 (267.8)	133 (264.3)	1.26 (1.1)
Living In HCC	7	158 (123.6)	146 (125.6)	1.57 (.79)
Living Independently	29	10 (32.9)	10 (30.4)	.28 (.53)
NE	60	347.3 (432.5)	315.9 (432.9)	1.55 (1.6)
Died	40	366.7 (454.3)	330.0 (458.6)	1.78 (1.64)
Living In HCC	9	669.2 (316.9)	623.8 (349.8)	2.11 (1.61)
Living Independently	11	13.3 (29.5)	13.0 (28.9)	.27 (.65)



Discussion

The data clearly shows the advantage of maintaining quality of life through regular exercise. The NE group had a 70% greater frequency of admission to the HCC (1.55 vs. 0.91), spent close to four times more days on average in the HCC (315.9 vs. 87.2 days) plus spent an average of three and a half times more days in the HCC during the last visit than the RE group (347.3 vs. 97.7 days).

The largest difference between the RE and NE groups was related to the number of days at the HCC. The non-exercisers spent close to 2 years in the HCC before passing away. This in contrast with the RE group who on average spent less than ½ year total at the HCC. In addition to the data, it was found that the RE group participated in many of the other health promotion activities and had a more active lifestyle that included activities ranging from work, hobbies, volunteering or participation in special projects.

However, one also has to consider the possibility that a resident could pass away instantaneously or have a prolonged morbidity time regardless of exercising or not exercising. There are unforeseen things that happen in life. Moreover, one can conclude that once a resident is admitted to the HCC, it is more than likely that they will remain at the HCC until death. This is clearly shown by comparing the number of HCC days for the people in the HCC with the independent people. Also, the total number of days at the HCC is only slightly larger than the number of days during the last visit. Therefore, the majority of the total numbers of days at the HCC are spent during the last visit. This is also confirmed by the small number of admissions to the HCC. Hardly any residents were admitted more than twice.

Another effect of regular exercise becomes evident by comparing the total number of HCC days for the residents who lived independently. The NE group stayed longer in the HCC than the RE group. Because the number of admissions between the two groups is about the same, one may conclude that the admission periods are longer. This could be related to exercise injuries that take longer to heal, especially for older people.

Based on the total population, in the study there was no difference in longevity between the NE and RE groups as the average age at the time of death (90.62 vs. 90.66) was almost the same. However, when

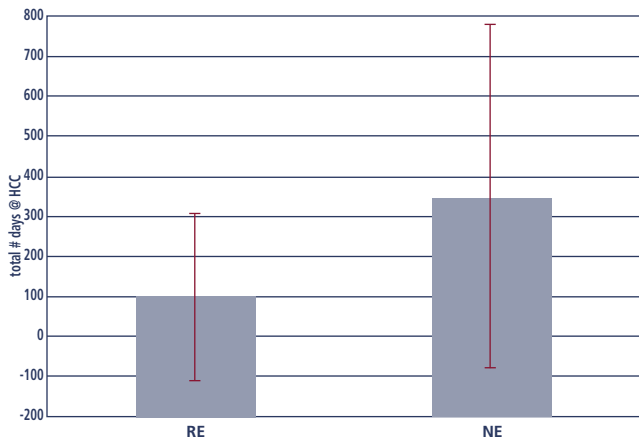


Figure 1 Total number of HCC days with Standard Deviation.

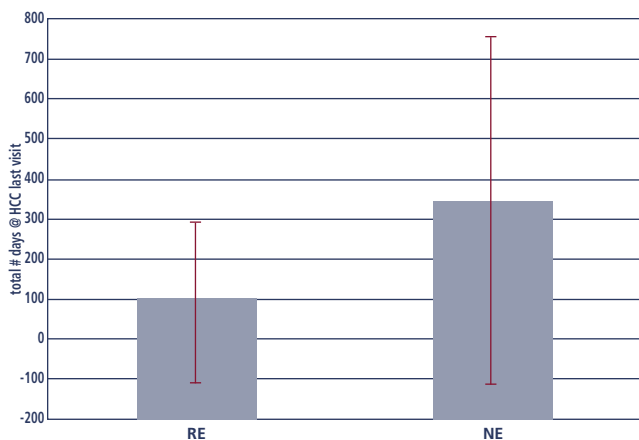


Figure 2 Total days of last visit at HCC with Standard Deviation.

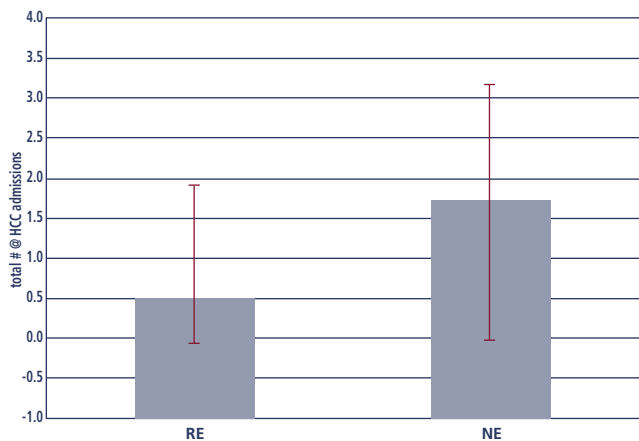


Figure 3 Total numbers of admissions with Standard Deviation.

taking everything into consideration it is clear that a higher quality of life is maintained by keeping active and fit through individually tailored moderate to intense physical activity. By doing so, not only will the individual benefit; but it will also have positive economic, social and emotional impacts for all involved and society as a whole.

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Viability of PKU Mice

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Abstract

Phenylketonuria (PKU) is a metabolic disorder in which phenylalanine (phe) is not correctly converted into tyrosine (tyr). This disorder causes an excess of phe to accumulate in the blood, which can cause mental retardation and other debilitating affects. In this study, mice were used as a model to study PKU. Matings were performed with a male homozygous mutant genotype and a female heterozygous mutant genotype. The sex and phenotype were collected when mouse pups were weaned from their mother. The data were analyzed to investigate the hypothesis that mutant PKU mice will have a survival rate at weaning no lower or higher than that of non-PKU mice. The results indicated that the null hypothesis was rejected. There was a significant drop in mouse survival of PKU mutants compared to that of non-PKU mice. One possible explanation is that PKU mutant mice are runted at birth so they compete for attention and food; however, it is unclear at this time what the definitive cause may be. This may be uncovered upon further research.

Viability of PKU Mice

Phenylketonuria (PKU) is an inborn error of metabolism. In this disorder, a mutation interrupts the metabolic pathway that transforms phenylalanine (phe) to tyrosine (King, 2005). Normally this reaction takes place because of an enzyme called phenylalanine hydroxylase. In people with PKU, the phenylalanine hydroxylase protein is misshaped due to a mutation in the structural gene. This leads to an excess of phe in the body which can lead to mental retardation as well as other maladies. However, with a special diet that contains low phe, many PKU patients can lead normal lives. There is a lot known about the biochemistry of the disorder; however, there are still important unanswered questions about many other aspects of the disorder, such as: a) How does it affect the brain, heart and other important organs? and b) What is the best treatment?

To answer these questions, genetic research on animals must be done. An animal disease model was discovered nearly fifteen years ago and is still used today. In order for the disease model to be successful, it must be well characterized. A review of the literature revealed minimal information about an important aspect of the classic

model, postnatal viability. In order to investigate postnatal viability, data was gathered concerning sex and phenotype of the offspring and historical records were reviewed to determine the survival rates. For this analysis, the null hypothesis was that there would be no difference in viability of PKU mice compared to non-PKU mice. Before the experiment, however, it is vital to provide information on the disorder.

PKU was first discovered by Dr. Fölling in 1934 when he was working with two mentally retarded children (Centerwall & Centerwall, 2004). Untreated PKU patients suffer most readily from mental retardation, which is irreversible and worsens over time. Every time a baby is born in the United States and in many other countries, the Guthrie test is performed (Koch, 2005). This is a simple blood test that will show whether there is excess phe in the blood. If there is excess phe and the baby is diagnosed with PKU, it will be put on a very restrictive diet to control the level of phe in the body. This disorder is caused by a mutation in the *Pah* gene.

There has been extensive research conducted to learn about PKU. The original treatment used to lower phe levels in the body was composed of a soup that had to be eaten up to five times a day (MacDonald et al, 2004). This soup had an extremely bad taste and was expensive, thus, new methods had to be invented. Christineh Sarkissian et al. proposed using ancillary phenylalanine ammonialyase which converts phe to a harmless metabolite (1999). Another study performed by Brumm et al. investigated the effects of phe levels in relation to the neuropsychological outcome of PKU patients (2003). They discovered that many PKU patients that were diagnosed with PKU as a baby and who were on the diet until about age 6 had normal functions except they lacked the ability to sustain focus, had low verbal skills, and higher instances of depression and anxiety. A study performed by Carolyn Smith and Julia Kang concurred with Brumm et al. in that they found the low phe diet did not completely diminish mental retardation (2000). This research was also performed using the mouse model. A study performed by Leze Zagreda et al. investigated learning behavior of PKU mice. In these experiments PKU mutant mice showed no latent learning whereas the non-mutant and heterozygous non-mutant animals showed latent learning. This research shows that there are cognitive deficits in PKU mice (Zagreda,1999).

In order to do all of these experiments, a genetic disease model had to be established. Many experiments have been performed to discover a way to research PKU using an animal model. The article “Mouse Models of Human Phenylketonuria” by Shedlvosky, McDonald, Symula, and Dove (1993), describes the mutation strain most often used in animal testing. This mutant mouse strain is used because a specific mutation was found that produces a very similar genotype in the *Pah* gene and a similar phenotype to humans. The mouse mutations that were discovered were named *Pah^{emu1}* and *Pah^{emu2}* genes. The *Pah^{emu2}* gene causes typical PKU and the *Pah^{emu1}* gene causes mild PKU (McDonald & Charlton, 1996). Most experiments with mice are now performed with the mice containing the *Pah^{emu2}* mutation.

The review of the literature on PKU revealed nothing that corresponded with the focus of this research which examines the viability of PKU mice compared to non-PKU mice as well as viability of male PKU mice to female PKU mice. In order for patients to gain knowledge and insight on PKU and how it will actually affect them, it is crucial to know how damaging this disorder can be if untreated. Such experiments are beyond the scope of humans; however, the mouse model can be used by many researchers. For the purposes of this research, historical records were reviewed of mice that have been raised with the particular mutation and have either survived to weaning or not. Data sets from the review were compared using the chi-square test.

Methods

The mice are housed at Wichita State University in an animal care facility. This research use of PKU mice was approved by the Institutional Animal Care and Use Committee. The facility is monitored daily by technical staff; the temperature is kept at 20°C and the light/dark cycle is at 12 hours. Plastic cages house the mice. There is a metal grate on top of each cage that contains a water bottle and food pellets. A ventilated plastic lid then covers the top of the cage; the bedding consists of shredded Aspen wood.

In order to study the PKU offspring, a cross was set up between a male homozygous mutant and a female heterozygote; this produces 50% mutant and 50% heterozygote offspring.



		Male	
		m	m
Female	m	mm Mutant	mm Mutant
	+	m+ wildtype	m+ wildtype

To mate the mice the male is put in with the female for a number of days. After signs of conception, the mother is allowed to have a full pregnancy and birth. The pups are then weaned from their mother after about three weeks of postnatal development. At weaning each pup is put into his/her own cage and a card is made up. The card has the following information on it: parent ID numbers, sex, and PKU phenotype. This information is also kept in a notebook, which is used for other experiments. For this experiment we used the sex and the PKU phenotype. Sex is determined by looking at the space between the genital region of each mouse and the anus. If the two are close together then the mouse is female, if they are far apart the mouse is male. Phenotype was distinguished by the color of the fur; if the mouse has beige fur color they have PKU.

After retrieving data records from the initial start date of the project in 1997, and collecting current data, an analysis was conducted using a Chi-square. The Chi-square test was used to determine a goodness of fit between observed and expected classes of offspring. In other words, the purpose of the analysis was to determine if the differences seen in the data were of sufficient magnitude to represent a real difference.

Results

The first null hypothesis stating that there will be no difference in viability of PKU mutant mice compared to non-mutant mice was rejected. The second hypothesis stating there will be no difference in viability of PKU mutant males and PKU mutant females was accepted. The degrees of freedom is two; therefore, the p value is the following:

	FM	MM	FWT	Total
Observed	513	328	510	1351
Expected	450.3	450.3	450.3	1351
(o-e) ² /e	8.73	33.21	7.91	

Discussion

Although there was a significant difference in survival to weaning among PKU mutant mice versus PKU wildtype mice, there are a number of factors that may have caused the difference. PKU mutant mice are runted which means they compete harder for food and care. Female mice are also runted, and they still distributed evenly, which leads to the conclusion that may be another reason for the rejection of the hypothesis.

One possible problem with the data is that there appeared to be too many litters of pups born that had no males, no females, or no mutants. This alone could have caused the data to sway in one direction. Another possible data explanation is that half way through retrieval of data it was noticed that there were very few male non-mutant mice recorded. This was because, for some of the litters, male mice were culled at birth. The culling process was undertaken because the male non-mutant mice were not needed in future mating and to remove them would remove a source of competition for survival. In order to get past this shortcoming, we were able to compare the female mutant mice to the female non-mutant mice. Because of the lack of females in each litter, however our data is not conclusive. If the number of culled mice had been recorded in the past, this study may have had more conclusive results, which would have produced a more concrete rejection or acceptance of our null hypothesis. Further research must be performed to understand what the cause of the anomaly actually is. For example if one were to follow the mouse offspring from birth to weaning, or even from conception to weaning, more information would be gained that could lead us to further knowledge regarding the results of this research.

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Design and Update of a Ground Vibration Test Model

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1.0 Nomenclature

A	Area
ADC	Analogue to Digital Converter
BC	Boundary Condition
C1	Configuration 1
CP	Pressure coefficient
DFRC	Dryden Flight Research Center
DOF	Degree of Freedom Young's Modulus
EBM	Equivalent Beam Model
f	Frequency vector
FE	Finite Element
FEM	Finite Element Model
ft	Feet
G	Gravity
GVT	Ground Vibration Test
HALE	High Altitude Long Endurance
Hz	Hertz
i	Dummy variable
I	Moment of inertia
I_1, I_2	Area moments of inertia
in	Inches
IRS	Improved Reduced System
I_{xx}	Computed x moment of inertia about center of gravity
$(I_{xx})_G$	Target x moment of inertia about center of gravity
I_{yy}	Computed y moment of inertia about center of gravity
$(I_{yy})_G$	Target y moment of inertia about center of gravity
I_{zz}	Computed z moment of inertia about center of gravity
$(I_{zz})_G$	Target z moment of inertia about center of gravity
J	Torsional constant
J_i	Objective function
K	Stiffness matrix
L	Length
L_1	Outboard wing length
L_2	Inboard wing length
M	Mass matrix
MAC	Modal Assurance Criterion
MPC	Multiple Point Constrains
NASA	National Aeronautics and Space Administration
Pro-E	Pro-Engineer software
ROA	Remotely Operated Vehicle
RW	Right Wing

RWI	Right Wing Inboard
RWO	Right Wing Outboard
SEREP	System Equivalent Reduction Expansion Process
T	Transposed
V & V	Verification and Validation
W	Total mass / computed total mass
W_G	Target (GVT) total mass
x	State vector
X	x-coordinate of computed center of gravity
X_{CG}	x-coordinate of center of gravity
X_G	x-coordinate of target center of gravity
Y	y-coordinate of computed center of gravity
Y_{CG}	y-coordinate of center of gravity
Y_G	y-coordinate of target center of gravity
Z	z-coordinate of computed center of gravity
Z_{CG}	z-coordinate of center of gravity
Z_G	z-coordinate of target center of gravity
3D	Three – dimensional
—	Error
Φ	Eigen-matrix / mode shapes
Φ_{mj}	Analytical mode shapes
Φ_{ak}	Experimental mode shapes
$\Omega /$	Eigen-vectors / frequencies
—	Poisson's ratio

2.0 Abstract

This paper describes the initial design and analytical phases of a GVT model with five different configurations. The long term objective of this effort is to develop new GVT techniques to accurately measure frequencies and mode shapes for a flexible, long aspect ratio type of airframe. Initially, FEMs of the five configurations were created. A static analysis under gravity was performed to select the appropriate aluminum thickness for each part. The selection was based on the requirements of linear static deflection at the wingtips for three configurations and non-linear deflection for two configurations. A dynamic analysis was performed to check appropriate connections among the parts. Finally, an equivalent beam model was created for one of the configurations. The optimization method used updated mass and stiffness properties. Frequencies and mode shapes for the first 20 modes were later matched, with frequency errors ranging from 0.092 to -17.472 % and MAC errors ranging from 80.17 to 99.98 %. Mass and stiffness orthogonalities were also checked. Although the



final EBM had only 0.6 % of the nodes and elements of the detailed FEM, it was almost as accurate but outstandingly more efficient than the detailed FEM.

3.0 Summary

The initial design and analytical phases of a GVT model with five different configurations are described. The long term objective of this effort is to develop new GVT techniques to accurately measure frequencies and mode shapes for a flexible, long aspect ratio type of airframe. Initially, FEMs of the five configurations were created. The airframe configurations under analysis were: 1) single engine, flexible; 2) single engine, non-flexible; 3) twin engine, flexible; 4) twin engine, non-flexible; and 5) eight engine, non-flexible.

A static analysis under gravity (MSC/NASTRAN - Solution 101) was performed to select the appropriate aluminum thickness for each part from the materials in stock at NASA DFRC. The selection of thickness was based on the requirements of having linear static deflection at the wingtips for configurations 2, 4, and 5 and non-linear deformation for configurations 1 and 3. A dynamic analysis at $G = 0$ (MSC/NASTRAN - Solution 103) was performed to check appropriate connections among the assembly parts, which was met by having the first six frequencies equal to zero Hz.

Finally, an equivalent beam model was created for the detailed FEM of configuration 1. The approach followed was to first create an EBM for some of the components in order to get within a feasible design region. Therefore, the mode-matching sequence was right outboard wing, right inboard wing, entire right wing, and, finally, configuration 1. The optimization method used was updating mass and then stiffness properties. The mass properties were updated in the following sequence: match total mass, match CG location, match mass moments of inertia, and minimize off-diagonal terms in orthogonal mass matrix. The sequence to update stiffness properties was: match frequencies, match mode shapes, and/or minimize off-diagonal terms in orthogonal stiffness matrix.

Mass properties, frequencies and mode shapes for the first 20 modes were matched; having errors in frequencies between 0.092 and -17.471 %, while the MAC error ranged from 80.17 to 99.98 %. The final EBM for configuration 1 had a mere 0.6 % of the nodes and elements of the detailed FEM. Nonetheless,

the new beam model was almost as accurate but outstandingly more efficient than the detailed FEM.

4.0 Introduction

4.1 Background

4.1.1. Finite Element Modeling

Finite Element Models (FEMs) are used to analytically predict the aeroelastic and aeroservoelastic properties of aerospace structures¹ and to “simulate the response of structures due to static or dynamic loads with the intention to gradually replace expensive tests conducted on prototypes².” A structure’s dynamic characteristics can be modeled within a given frequency range. This model is formed by individual vibration modes and their corresponding natural frequencies, damping factors, and modal shapes³.

The finite element method does not restrict in the complexity of a structure. For a continuous structure, the FE method results in a discrete system of second order differential equations (in the form of banded and symmetric matrices) that represent mass and stiffness. The FE method divides the structure into an N number of discrete areas or volumes called elements. Each of these elements possesses a geometrical formula independent of the overall structure⁴.

The FE model for the entire structure is obtained by adding the mass and stiffness terms of the individual elements. This is possible because the elements are tied together by common nodes, which share exactly the same motion. Physically, the eigenvalues represent the square of the natural frequency of vibration while the eigenvectors represent the mode shapes. There are no quadratic systems, such as those for mass and stiffness, defined for damping in structural dynamics. In most cases, damping can be neglected when the values are sufficiently low or simplified models can be created⁴.

4.1.2. Errors in Finite Element Modeling

There are three types of errors in FE models that could either affect the physical meaning of parameters or the comparison with experimental results⁵. These are discretisation errors, configuration errors, and parameter errors. Discretisation errors “come from modeling a continuous system by a discrete numerical system⁵.” Errors in the mass and stiffness matrices can result from distorted elements in

the mesh⁴. Discretisation errors cause that even when the parameters of the model are correct, the dynamic properties predicted by the FE model are incorrect⁶.

Configuration errors are caused by simplifications made in the modeling process, such as joints, kinematic constraints, and damping⁷. Joints and boundary conditions, in particular, represent greater model uncertainties than continuous parts⁸. Configuration errors could lead to inaccurate predictions in the dynamic properties of the structure near the high-frequency ranges⁶. In order to mitigate this problem, the stiffness (and possibly mass) of joints and constrained boundaries must be accounted for in modeling.

The third type of modeling error, parameter errors, results from parameters with uncertain values⁶. Some of the errors discussed can be improved by selecting uncertain parameters as design variables in model updating; this as long as the initial parameter values fall within a feasible range of convergence (refer to section 4.3) and as long as the eigenvalues are sensitive to these parameters. Therefore, it is very important to assess the uncertainty in the model. Otherwise, the assessment of the uncertainty in the updating parameters will not be possible.

4.1.3. Ground Vibration Testing

GVT results are used for flutter predictions, updating and verification of analytical model, and aircraft aeroelastic certification³. The measurement hardware used in ground vibration testing includes: a mounting system, means to excite the structure, transducers to measure the force input and the response of the structure (piezoelectric materials), and a method of recording and analyzing the data⁴.

The mounting system could include a model base, flexible springs to simulate “free-free” boundary conditions, and clamped mounts. Means to excite the structure could be a shaker, and instrumented hammer (with force transducer added below the tip), or a static force⁴.

When using a shaker, the user specifies the input voltage, which results in a proportional force. There are two types of shakers: electromagnetic and electrohydraulic. The electrohydraulic shaker produces greater force but has a limited frequency range and it is not recommended for use. The electromagnetic shaker involves an electric signal

being transferred to a coil of wire inside a magnetic field. The resulting coil motion is transferred using a shaft to produce a force input to the structure⁴.

It is recommended to use multiple shakers to have a better distribution of energy and to avoid missing modes. Some of the disadvantages of using shakers include errors in testing derived from the method used to attach the shaker. For instance, direct bolting of the shaker to the structure could produce the effects of increasing the mass at the connection point (mass loading) and the local stiffness. Among the advantages of shakers we have the production of more energy, a more even distribution of energy when more than one shaker is used, and the production of more data⁴.

Instrumented hammers are used to impact a structure. A large force in a small time would produce a change in momentum that, in turn, would excite all frequencies equally. Frequencies above the cut-off frequency of the hammer impact will not be excited. On the other hand, a high cut-off frequency will excite frequencies that are not of interest and would leave only a small amount of energy to excite the lower frequencies of interest. Some of the advantages of using a hammer are that it is easy to use and that it does not add a significant mass loading. Disadvantages are that sometimes it is difficult to get the desired impact force. For example, large impacts could potentially damage the structure or produce non-linear inputs while a very small impact may not produce a satisfactory response⁴.

A third method to excite a test model is to preload the structure with a static force. When this force is released, a step relaxation produced acts as a force input⁴.

In order to measure a force input and test model response, transducers produce an electric charge that is converted into voltage by signal conditioning. “Force transducers apply the force directly to the piezoelectric material” (pp. 40). In an accelerometer, the piezoelectric material connects the mass to the structure. The piezoelectric material then receives an inertial force resulting from the acceleration of the structure⁴.

Analogue to Digital Converters (ADCs) are used to analyze the data obtained from testing. The sampling rate of ADCs is chosen to be no less than twice the higher frequency recorded. Aliasing is produced when two analogue signals with different frequencies appear to be the same when converted to digital signals or, in



other words, high frequencies are confused with low frequencies. This phenomenon is caused by a slow sampling rate and it can be fixed using an anti-aliasing filter⁴.

4.1.4. Measurement Noise: Random and Systematic Errors⁴

There are two types of errors in testing that cause measurement noise: random and systematic errors. Random errors could be reduced by averaging the data, by using an appropriate experimental technique, and by using an appropriate excitation method. For example, hammer inputs could create noise because they transmit low energy levels to the structure, while a step sine input would allow more data average and, therefore, would reduce noise.

Systematic errors are usually difficult to eliminate and they can be produced by: mounting of the structure (for example, if there is certain flexibility in a supposedly clamped structure), transducers and shakers (which may produce mass loading and increase local stiffness), and modal extraction methods (which can produce “statistically biased estimates or computational modes which are not properties of the structure⁴” (pp. 53)). Frequency estimates are usually accurate while estimates in mode shapes and damping usually contain noise.

4.2 Motivation

4.2.1 Model Verification and Validation

The goal of model verification and validation (V & V) is to create computational models that predict the dynamic behavior of a structure. Compared to full-scaled ground vibration tests (GVT), these models are more cost, time, and risk efficient. “Verification is the process of determining that a model implementation accurately represents the developer’s conceptual description of the model and its solution⁵.” “Model verification addresses the discretisation and configuration errors⁵.” “Validation is the process of determining the degree to which a model is an accurate representation of the real world from the perspective of the intended uses of the model. In short, verification is a math issue, whereas validation is a physics issue⁹.”

Although in the model verification and validation process analytical models are compared to experimental results, it is acknowledged that such

results are not free from errors either. Therefore, in order to validate the real predictive accuracy of analytical models, it is important to quantify uncertainties in both analytical and experimental results⁹.

Model updating is part of the validation process and represents an effort to correlate the predictions of frequencies and mode shapes of the analytical FE models with experimental results obtained in dynamic tests such as ground vibration testing (GVT). Model updating is important because even small errors in FEMs will predict an erroneous aeroservoelastic response¹. Some of the problems that arise when comparing analytical to experimental results in FEM updating could originate because the analytical model does not include damping, which could create complex modes⁴. Other contributing factors are inaccuracies found in testing and the fact that a large number of degrees of freedom in the analytical model cannot be captured in the experimental model since the number and location of transducers is limited⁴.

4.3 Theory

4.3.1 Generalities of Model Updating

The process of model updating is done by modifying design variables in the FE model⁵. Therefore, choice of the appropriate design variables is an important part in model updating⁴. Sensitivity analyses are conducted in order to detect the variables that affect the dynamic behavior of the structure in a desired frequency band³. The purpose of model updating is then to minimize the objective function while respecting some constraints placed on the model.

Updating will improve a model based on the completeness and precision of the data measurements of the test structure. Precision will be affected by random and systematic noise. Completeness, on the other hand, will be affected when the frequency range of the measurements is shorter than that of the analytical model, when the number of measurement stations is less than the number of degrees of freedom in the analytical model, or when measurements are taken at nodal positions⁴.

4.3.2. Model Updating Approach Used at NASA Dryden Flight Research Center¹

In the past, model updating at NASA DFRC was done by trial-and-error. FEM properties were modified

and then the new analysis was compared to GVT results. The process was repeated until satisfactory agreement between analytical and experimental results was achieved. This approach was very inefficient.

A new and more efficient approach is based on iterative optimization steps to reduce the difference between analytical and experimental results. The sequence of optimization is: match mass properties, orthogonalize mass matrix, and finally match frequencies and mode shapes. Design variables can include: thickness or area (structural sizing), concentrated mass information, density, Young's Modulus, and spring constants (material properties). It is very important that the initial optimization iteration starts within a feasible region.

In more detail, the steps followed are:

- Step 1: match mass properties (total mass, location of center of gravity, and mass moment of inertias) to have identical rigid body dynamics (see table 1).
- Step 2: improve mass matrix orthogonality by reducing as close to zero as possible the off-diagonal terms of the orthonormalized mass matrix and having 1s on the diagonal.
- Step 3: match frequencies and mode shapes using stiffness design variables only. Guyan Reduction (see section 4.3.3) or Improved Reduction System methods are used. In order for mode-matching to be successful, it needs to be started within a feasible domain.
- Step 4: improve stiffness matrix orthogonality

The requirements for orthogonality are:

$$\Phi^T M \Phi = [I] \text{ and } \Phi^T K \Phi = [\omega^2], \text{ where}$$

M = mass matrix

K = stiffness matrix

Φ = mode shapes or eigenvectors

ω = frequencies or eigenvalues

The modal assurance criterion (MAC) calculates the degree of correlation between analytical and experimental mode shape vectors. The governing equation is:

$$MAC_{jk} = \frac{|\Phi_{mj}^T \Phi_{ak}|^2}{(\Phi_{ak}^T \Phi_{ak})(\Phi_{mj}^T \Phi_{mj})}, \text{ where}$$

Φ_{mj} = experimental

Φ_{ak} = analytical

When updating a model, a MAC matrix that contains the correlation between analytical and experimental mode shapes is formed. Values close to 1 in the diagonal and close to zero elsewhere will result if the modes pair in numerical order⁵ (What about percentage MAC?).

The convergence criteria of this new approach is to have less than 3% frequency error in primary modes, less than 10% frequency error in secondary modes, and less than 10% error in off-diagonal terms in mass matrix. So far, the mode-matching code used for this approach only works for beam models.

4.3.3 Model Reduction

As has been previously said, hardware limitations result in incompleteness of data since responses are usually measured at a limited number of locations and frequency ranges. Reducing the number of degrees of freedom in the analytical model is used to deal with this problem⁴. Model reduction also helps in making the model more efficient for analysis; however, the dynamic properties of the model are usually affected after the reduction process¹⁰. Some of the methods used for model reduction include: Guyan or Static Reduction, Dynamic Reduction, Improved Reduced System (IRS), and System Equivalent Reduction Expansion Process (SEREP)⁴.

The Guyan or static reduction will be discussed in more detail since it is the method used in this project. In the Guyan reduction, "the state and force vectors (x and f) and the mass and stiffness matrices (M and K) are split into sub vectors and matrices relating to the masters degrees of freedom, which are retained, and the slaves degrees of freedom, which are eliminated⁴" (pp. 65). Slave degrees of freedom are chosen at locations where the inertia is low and stiffness is high. Selection of master degrees of freedom is reversed.

"The inherent drawback of the Guyan reduction process is that the mass of the reduced system is not effectively preserved and therefore will generally produce reduced model frequencies that are higher than those of the original full space model." The Improved Reduction System (IRS) approaches this problem by accounting for the DOFs that are eliminated in the Guyan Reduction. The Dynamic Reduction, on the other hand, forms a dynamic transformation matrix for dynamic studies¹⁰.



4.3.4. Modal Expansion⁴

Model expansion is the reverse of modal reduction. The measured mode shapes are expanded based on the analytical mode shapes to account for the unmeasured degrees of freedom at certain locations. Analytical and experimental mode shapes need to be scaled to apply modal expansion. The two most common methods of modal expansion are: expansion using mass and stiffness matrices and expansion using data from the finite element model. A summary of the model updating technique can be seen in figure 1.

5.0 Goals

5.1. Long Term Objectives

The long term objective of this project is to build a HALE ROA type of test model and to develop new GVT techniques to accurately measure frequencies and mode shapes of a light-weight, flexible airframe with a very high aspect ratio.

5.2 Short Term Objectives

The particular objectives of the research effort discussed in this paper are:

- Build Finite Element Model of five test configurations
- Select appropriate thickness of required parts based on static analysis under gravity
- Check model accuracy based on dynamic analysis under jig shape
- Build an equivalent beam model of detailed FEM for the first configuration

6.0 Model Description

6.1 Test Configurations

There are five different configurations for the GVT model. Configuration 1 represents a flexible model with a single engine and non-linear deformation at the wingtips. For configuration 2, the single engine model was modified with the addition of two wing stiffeners to have linear deflection at the wingtips. Configuration 3 is a twin engine, flexible model with non-linear deflection at the wingtips. In configuration 4, the twin engine case was modified with the addition of two wing stiffeners to have linear deflection at the wingtips. Finally, configuration 5 has eight engines and two wing stiffeners, causing a linear deflection at the wingtips. A summary of each configuration can be found in table 2 and in figure 2.

6.2 Materials and Required Parts

To facilitate the objectives of testing, the goal is that all five configurations have interchangeable parts. That way, a common test model would be assembled and each configuration would be changed with relative ease by adding and removing parts. The parts common to all configurations are: inboard and outboard wings, fuselage top, outboard wing connectors, fuselage beam, and empennage. The parts that will change among configurations are: engines (single, twin, eight), fuselage sides, fuselage bottom, wing stiffeners, inboard wing connectors, and fittings. The common model has a wingspan of 24 ft, a chord of 1 ft, and a nose-to-tip length of 3.8 ft. A summary of all the required parts and their dimensions is presented in figure 3.

Aluminum was selected for use because a very light model is desired and because of its relatively low cost. To reduce manufacturing costs even further, most of the aluminum parts will be gathered from the in-house stock at NASA DFRC. The thickness of each part was later defined through the static analysis described in section 6.

The FEM of each configuration was designed using MSC/PATRAN® and the analysis was performed with MSC/NASTRAN®. A summary of the elements used to model each part in MSC/PATRAN is found in table 3.

7.0 Static Analysis, G = 1

7.1 Approach

A static analysis was performed to select the appropriate thickness for each assembly part out of the materials in stock at NASA DFRC. MSC/NASTRAN Solution 101 – linear static was used for this purpose. Gravity and support cards were added to the input file. The gravity card added an inertial load to simulate a 1 G condition. The support card was used to account for the lack of boundary conditions in the model; otherwise, the model would have been infinitely pushed downward by the gravity load.

Different thicknesses were tried in the model in order to get a linear deflection at the wingtip (entire wing assembly) for configurations 2, 4, and 5 and a non-linear deflection at the wingtip (entire wing assembly) for configurations 1 and 3. On the other hand, linear deformation at the wing substructures was desired for all configurations. A summary of the required deformations can be seen in figure 4.

In order to have a linear wing assembly deformation, configuration 2, 4, and 5 needed to satisfy the following requirements:

$$\varepsilon < 0.1 \text{ and } \delta < 0.1L_2 < 7.2 \text{ in,}$$

while the requirement for the non-linear deformation of configurations 1 and 3 was:

$$\varepsilon < 0.2 \text{ and } \delta > 0.2(L_1 + L_2) > 28.8 \text{ in.}$$

7.2 Results and Discussion

The results for the static analysis and the materials chosen can be seen in table 4 and in figure 5. The maximum wingtip deflection was 30.5 in (non-linear) for configuration 3 and the minimum was 5.61 in (linear) for configuration 4. All configurations satisfactorily met the deformation requirements. The minimum thickness chosen was 0.1875 in for the angle connectors while the maximum was 0.5 in for the inboard wings as well as for the stiffener beams.

8.0 Dynamic Analysis, $G = 0$

8.1 Approach

MSC/NASTRAN Solution 103 – normal modes was used to perform the dynamic analysis at $G = 0$. The objective of the dynamic analysis was to make sure that the FEM of the five configurations was correct and, therefore, that there was no motion at the connection points.

8.2 Results and Discussion

To check that the parts were properly attached, the frequencies for the first six modes needed to be zero. All configurations showed satisfactory results. Frequency results from the dynamic analysis up to the tenth mode are seen in table 5.

9.0 Equivalent Beam Model

As was stated in the introduction, model updating is usually used to correlate an analytical FEM to experimental results. Since the GVT model discussed in this paper has not been built yet, there are no experimental results available. Nonetheless, model updating was used to develop an equivalent beam model that was just as accurate in dynamic computations but more efficient than the corresponding detailed FEM. For all cases exemplified below, the mode-matching approach described in section 3.3.2 was the method used. Before mode-matching configuration 1, the goal was to create the

equivalent beam model of each main component in order to start the design of configuration 1 within a feasible region. The sequence followed was to match the frequencies and mode shapes of the right outboard wing, right inboard wing, entire right wing, and finally the entire configuration 1 (flexible, single engine). E , v , A , I_1 , I_2 , and J were the chosen design variables. Each case will be discussed individually as follows.

9.1 Case 1 - Equivalent Beam Model of Right Outboard Wing

9.1.1 Approach

An equivalent beam model for the right outboard wing was built under fully-fixed (6 DOF) cantilevered conditions. 12 mass points were distributed along the beam. The detailed FEM had 2425 nodes while the EBM had 13. Both models are shown in figure 6.

9.1.2 Results and Discussion

Table 6 shows results for the matching of mass properties at the CG location. All the mass properties were matched to perfection except for Y_{CG} , with an error of 0.02 %, and I_{xx} and I_{zz} , with an error of 0.1 %. Table 7 shows the frequencies and MAC values before and after mode-matching while figure 7 shows the 4 matched modes. After mode matching, the maximum MAC value was 100 % (modes 1 and 2) while the minimum was 99.90 % (mode 3). The minimum frequency error was -0.006 % for mode 3 and the maximum was -3.003 % for mode 4.

9.2 Case 2 - Equivalent Beam Model of Right Inboard Wing

9.2.1 Approach

An equivalent beam model of the detailed FEM for the right inboard wing was built under a fully-fixed (6 DOF) cantilever condition. An equivalent mass point at the CG location of the right outboard wing was added to have a more realistic approach. This mass point was attached to the inboard right wing using rigid bars so that the frequencies and mode shapes of the assembly would not be significantly affected. The mass of the right inboard wing was distributed in 17 lumped mass points located along the beam. The FEM had 2588 nodes while the EBM had 19. Figure 8 shows both models.



9.2.2 Results and Discussion

Table 8 shows results for the matching of mass properties at the CG location. All the mass properties were matched to perfection except for the weight, with an error of 0.07 %, Y_{CG} , with an error of -0.05 %, and I_{zz} , with an error of 0.1 %. Table 9 shows the frequencies and MAC values before and after mode-matching while figure 9 shows the 4 matched modes. After mode matching, the maximum MAC value was 99.99 % (mode 1) while the minimum was 99.72 (mode 2). The minimum frequency error was -0.001 % for mode 4 and the maximum was -1.945 % for mode 1.

9.3 Case 3 - Equivalent Beam Model of Entire Right Wing

9.3.1 Approach

An equivalent beam model was built for the entire right wing. The updated models discussed in sections 8.1 and 8.2 were used as starting configurations in order to begin the mode-matching process within feasible design regions. Both models were under a fully-fixed (6 DOF) cantilever condition. Spring elements were used in lieu of connector angles to connect the inboard and outboard wings. The mass of the entire wing was distributed along the entire beam using 25 lumped mass points. The detailed FEM had 5276 nodes while the equivalent beam had 26 nodes. Both models are seen in figure 10.

9.3.2 Results and Discussion

Table 10 shows results for the matching of mass properties at the CG location. The errors obtained for the mass properties were: weight (2.03 %), Y_{CG} (-1.94 %), I_{xx} (5.07 %), I_{yy} (1.97 %), and I_{zz} (5.12 %). Table 11 shows the frequencies and MAC values before and after mode-matching while figure 11 shows the 10 matched modes. After mode matching, the maximum MAC value was 99.97 % (mode 1) while the minimum was 99.0 (mode 4). The minimum frequency error was -0.058 % for mode 3 and the maximum was -6.160 % for mode 10.

9.4 Case 4 - Equivalent Beam Model of Configuration 1

9.4.1 Approach

An equivalent beam model was built for configuration 1 (flexible, single engine model) using the updated properties discussed in section 8.3 as

a starting point for the mode-matching process.

The FE model had a boundary condition at the nose constraining DOFs 1, 2, and 3. For the beam model, the boundary condition at the nose had all 6 DOFs constrained. The left wing was created using a mirror image of the right wing. In the EBM, the mass of configuration 1 was distributed among 72 lumped mass points. An equivalent mass for the empennage at the corresponding CG location was one of these points. The FEM solids, fuselage beam and empennage, had orphan rotational DOFs (4, 5, and 6). Therefore, such DOFs for 3D – solids were eliminated from the analysis. Total number of nodes was 11678 for the detailed FEM and 73 for the EBM. Both models are shown in figure 12. The total number of nodes for all cases is summarized in table 12.

9.4.2 Results and Discussion

Table 13 shows results for the matching of mass properties at the CG location. All of the mass properties were perfectly matched except for: weight (0.15 % error), X_{CG} (-0.81 %), I_{xx} (-0.63 %), I_{yy} (1.08 %), and I_{zz} (-0.59 %). Table 14 shows the frequencies and MAC values before and after mode-matching while figure 13 shows the 20 matched modes. After mode matching, the maximum MAC value was 99.98 % (mode 1) while the minimum was 80.17 (mode 9). The minimum frequency error was 0.092 % for mode 18 and the maximum was $\text{abs}(-17.47)$ % for mode 8. The final updated beam properties for the fuselage top, fuselage beam, and inboard and outboard wings appear in table 15. Minimum and maximum errors for all cases after mode-matching as well as a comparison of the nodes used in the FEMs and EBMs are shown in figures 11678 and 73 respectively.

10.0 Conclusions

The study here described was successful in completing the initial design phase of the GVT model planned for the development of a new GVT approach. Accurate FEMs for the five configurations of the model were built and sizing requirements were established as a result of dynamic and static analyses respectively. In addition, an equivalent beam model of one of the configurations under study was created. This EBM was considerably more efficient than its FEM counterpart, albeit it had a mere 0.6 % of the elements and nodes of the detailed FEM.

11.0 Future Work

Tasks for the future include:

- Create an Equivalent beam model for configurations 2 – 5. The parts already updated could be used as a starting point.
- Perform trim analysis and get CPs and static aero loads.
- Create Pro-E drawings for manufacturing
- Manufacture test article
- Test model in all five configurations. Develop new GVT techniques for a HALE ROA type of vehicle.

12. References (needs to get complete reference information)

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Table 1. Optimization Problem Statement for Mass Properties

Item	Objective Function	Constraints
1	$J_1 = W - W_G$	Unconstraint
2	$J_2 = X - X_G$	$ J_i < \epsilon$
3	$J_3 = Y - Y_G$	$ J_i < \epsilon \quad i=1,2$
4	$J_4 = Z - Z_G$	$ J_i < \epsilon \quad i=1, E \ 3$
5	$J_5 = I_{XX} - (I_{XX})_G$	$ J_i < \epsilon \quad i=1, E \ 4$
6	$J_6 = I_{YY} - (I_{YY})_G$	$ J_i < \epsilon \quad i=1, E \ 5$
7	$J_7 = I_{ZZ} - (I_{ZZ})_G$	$ J_i < \epsilon \quad i=1, E \ 6$
8	$J_8 = I_{XY} - (I_{XY})_G$	$ J_i < \epsilon \quad i=1, E \ 7$
9	$J_9 = I_{YZ} - (I_{YZ})_G$	$ J_i < \epsilon \quad i=1, E \ 8$
10	$J_{10} = I_{ZX} - (I_{ZX})_G$	$ J_i < \epsilon \quad i=1, E \ 9$

Table 2. Configuration Summary

Configuration	Engines	Deflection
1	1	Non-linear
2	1	Linear
3	2	Non-linear
4	2	Linear
5	8	Linear

Table 3. Summary of Required Parts

Part	NASTRAN	Number
Inboard wing	Plate	2
Outboard wing	Plate	2
Twin Engines	Solid	2
Eight Engines	Solid	8
Fuselage top	Plate	1
Fuselage bottom	Plate	1
Fuselage sides	Plate	2
Fuselage beam	Solid	1
Empennage	Solid	1
Stiffener beam	Beam	2
Stiffener plate	Plate	4
Fittings	Solid	4
Bolts and nuts	MPCs	?

Table 4. Thickness and Materials

Part	Thickness (in)	Material
Outboard wings	0.375	2024 T351 Aluminum Sheet
Inboard wings	0.5	2024 T351 Aluminum Sheet
Connector angles	0.1875	6061-T6 Angles Extruded
Fuselage plates	0.375	2024 T351 Aluminum Sheet
Stiffener plate	0.25	2024 T351 Aluminum Sheet
Stiffener beam	0.5	2024 T351 Aluminum Sheet

Table 5. Results for Dynamic Analysis (G=0)

Conf	FREQUENCIES (Hz)			
	M7	M8	M9	M10
1	1.0452	2.2491	4.4837	9.3601
2	1.7153	2.5117	10.404	11.281
3	1.0333	2.1383	4.2704	9.3425
4	1.7806	2.5297	10.423	11.377
5	1.6836	2.4794	10.162	11.026

Table 6. Mass Properties (Right Outboard Wing)

	Detailed FEM	Equivalent Beam	Error (%)
Weight	32.72	32.72	0.0
X_{CG}	6.0	6.0	0.0
Y_{CG}	108.0	107.98	0.02
Z_{CG}	0.0	0.0	0.0
I_{XX}	14139.9	14125.69	0.1
I_{YY}	394.05	394.06	0.0
I_{ZZ}	14533.9	14520.05	0.1
I_{XY}	0.0	0.0	0.0
I_{XZ}	0.0	0.0	0.0
I_{YZ}	0.0	0.0	0.0

Table 7. Frequencies and MAC Values (Right Outboard Wing)

Mode	Detailed FEM (HZ)	Initial EBM* (HZ)	Error (%)	Final EBM* (Hz)	Error (%)	MAC* (%)
1	2.310	1.805	21.845	2.332	0.942	100
2	14.461	7.149	50.564	14.461	-0.966	100
3	27.173	14.602	46.260	27.173	-0.006	99.90
4	40.542	21.473	47.035	39.325	-3.003	99.97

Table 8. Mass Properties (Right Inboard Wing)

	Detailed FEM	Equivalent Beam	Error (%)
Weight	76.05	75.99	0.07
X _{CG}	6.0	6.0	0.0
Y _{CG}	67.12	67.15	-0.05
Z _{CG}	0.0	0.0	0.0
I _{xx}	128574	128571.30	0.0
I _{yy}	914.45	914.45	0.0
I _{zz}	129486	129360.20	0.1
I _{xy}	0.0	0.0	0.0
I _{xz}	0.0	0.0	0.0
I _{yz}	0.0	0.0	0.0

Table 9. Frequencies and MAC Values (Right Inboard Wing)

Mode	Detailed FEM (HZ)	Initial EBM* (HZ)	Error (%)	Final EBM* (Hz)	Error (%)	MAC* (%)
1	0.900	0.860	-4.474	0.882	-1.945	99.99
2	6.353	4.610	-27.432	6.474	1.899	99.72
3	19.825	17.523	-11.613	19.829	0.019	99.77
4	21.285	9.794	-53.984	21.285	-0.001	99.82

Table 10. Mass Properties (Entire Right Wing)

	Detailed FEM	Equivalent Beam	Error (%)
Weight	76.96	75.40	2.03
X _{CG}	6.0	6.0	0.0
Y _{CG}	67.18	68.48	-1.94
Z _{CG}	0.0	0.0	0.0
I _{xx}	128603	122087.7	5.07
I _{yy}	926.92	908.68	1.97
I _{zz}	129529	122894.1	5.12
I _{xy}	0.0	0.0	0.0
I _{xz}	0.0	0.0	0.0
I _{yz}	-1.1	-0.80	27.28

Table 11. Frequencies and MAC Values (Entire Right Wing)

Mode	Detailed FEM (HZ)	Initial EBM* (HZ)	Error (%)	Final EBM* (Hz)	Error (%)	MAC* (%)
1	0.793	0.834	-5.170	0.803	1.198	99.97
2	3.517	4.101	-16.610	3.661	2.508	99.94
3	11.710	11.582	1.093	11.703	-0.058	99.85
4	17.650	17.795	-0.822	17.809	0.898	99.00
5	18.105	19.659	-8.583	17.848	-1.420	99.92
6	20.647	21.453	-3.904	20.239	-1.978	99.87
7	36.531	36.647	-0.318	35.857	-1.847	99.82
8	43.879	43.775	0.237	44.400	1.188	99.75
9	54.937	52.017	5.315	52.010	-5.329	99.80
10	74.781	77.957	-4.247	70.174	-6.160	99.72

Table 12. Summary of Nodes Used (All Configurations)

Case	FEM Nodes	Beam Nodes	Modes Matched
RWO	2425	13	4
RWI	2588	19	4
RW	5276	26	10
C1	11678	73	20

Table 13. Mass Properties (Configuration 1)

	Detailed FEM	Equivalent Beam	Error (%)
Weight	162.27	162.02	0.15
X _{CG}	6.57	6.63	-0.81
Y _{CG}	0.0	0.0	0.0
Z _{CG}	-0.02	-0.02	0.0
I _{xx}	955043.10	961017.40	-0.63
I _{yy}	4543.32	4494.06	1.08
I _{zz}	959580.90	965214.10	-0.59
I _{xy}	0.0	0.0	0.0
I _{xz}	21.66	21.66	0.0
I _{yz}	0.0	0.0	0.0

Table 14. Frequencies and MAC Values (Configuration 1)

Mode	Detailed FEM (HZ)	Initial EBM* (HZ)	Initial Error (%)	Final EBM* (Hz)	Final Error (%)	Final MAC* (%)
1	0.712	0.665	6.539	0.710	-0.318	99.98
2	0.774	0.776	-0.230	0.825	6.562	99.82
3	3.297	3.047	7.584	3.097	-6.065	99.46
4	3.539	3.503	1.013	3.569	0.851	99.68
5	4.611	9.220	-99.960	4.316	-6.417	99.33
6	10.626	10.310	2.974	10.678	0.493	99.87
7	11.150	11.243	-0.832	11.567	3.733	84.79
8	16.312	13.102	19.681	13.462	-17.472	98.62
9	17.292	17.288	0.023	17.117	-1.014	80.17
10	17.744	17.322	2.377	17.507	-1.333	98.54



Table 14. Frequencies and MAC Values (Configuration 1) –continued–

Mode	Detailed FEM (HZ)	Initial EBM* (HZ)	Initial Error (%)	Final EBM* (Hz)	Final Error (%)	Final MAC* (%)
11	18.615	17.524	5.862	17.648	-5.195	99.12
12	18.874	17.699	6.223	17.609	-6.702	99.16
13	19.554	19.164	1.994	19.706	0.777	92.30
14	20.831	22.954	-10.20	22.266	6.888	99.92
15	34.879	33.583	3.717	34.344	-1.535	99.16
16	35.648	34.908	2.075	35.366	-0.791	96.60
17	41.161	39.789	3.333	38.844	-5.630	91.41
18	42.346	43.471	-2.656	42.385	0.092	89.60
19	48.177	44.464	7.349	46.208	-4.088	98.23
20	49.753	48.196	3.130	49.974	0.443	90.47

Table 15. Initial and Final Equivalent Beam Properties (Configuration 1)

	Inboard wings		Outboard wings		Fuselage beam		Fuselage top	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
A	6.0	5.98	4.5	6.0	1.0	1.03	2.25	3.66
I ₁	0.125	0.144	0.053	0.055	0.083	0.070	6.75	1.10
I ₂	72.0	66.48	54.0	64.08	0.083	0.070	0.03	0.05
J	0.487	0.515	0.207	0.245	0.141	0.141	0.101	0.141

Figure 1. Mode-Matching Technique

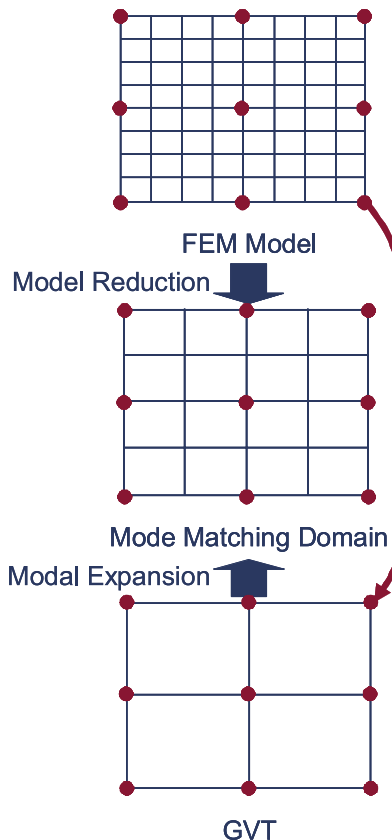


Figure 2a. Configuration 1 (Single, Engine, Flexible)

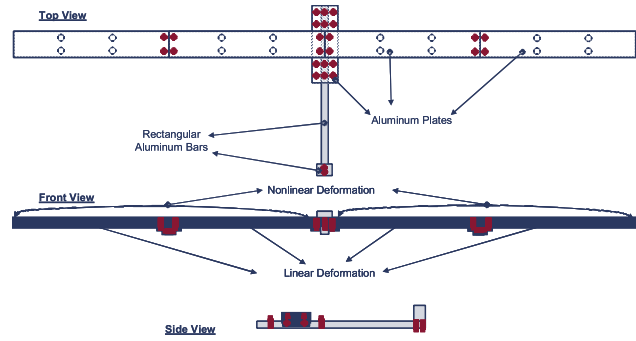


Figure 2b. Configuration 2 (Single, Engine, Non-Flexible)

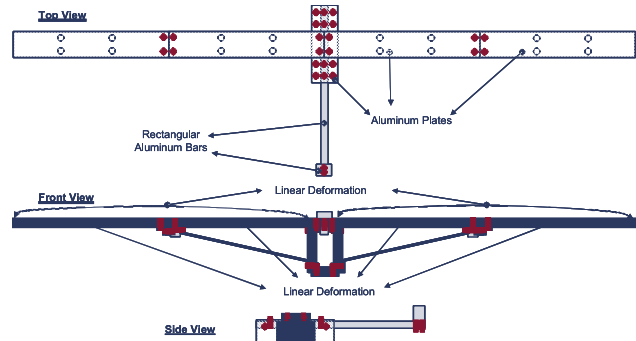


Figure 2c. Configuration 3 (Twin Engine, Flexible)

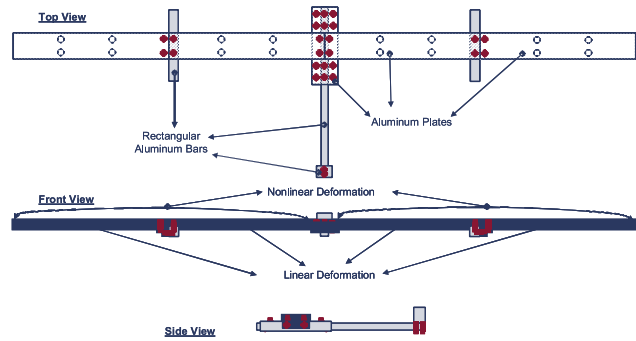


Figure 2d. Configuration 4 (Twin Engine, Non-Flexible)

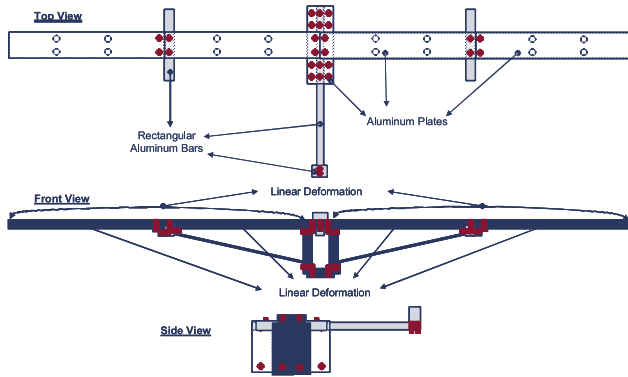


Figure 2e. Configuration 5 (Eight Engines, Non-Flexible)

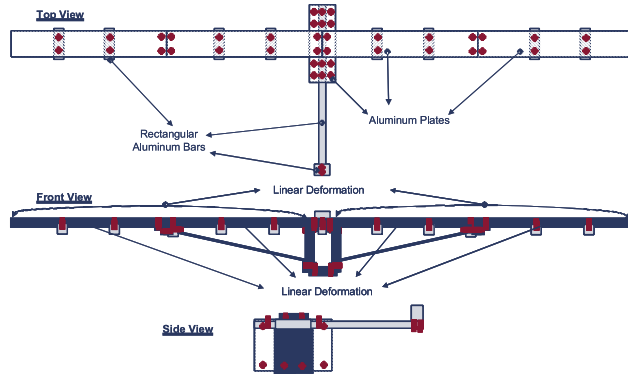
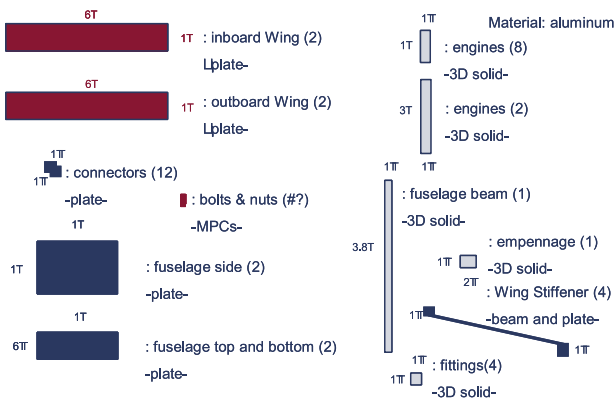


Figure 3. Summary of Dimensions and Required Parts



*Figure created by Dr. Chan-gi Pak & modified by Norma Campos
Figure 3. Summary of dimensions and required parts

Figure 4a. Linear Deformation Constraints (Wing Substructures)

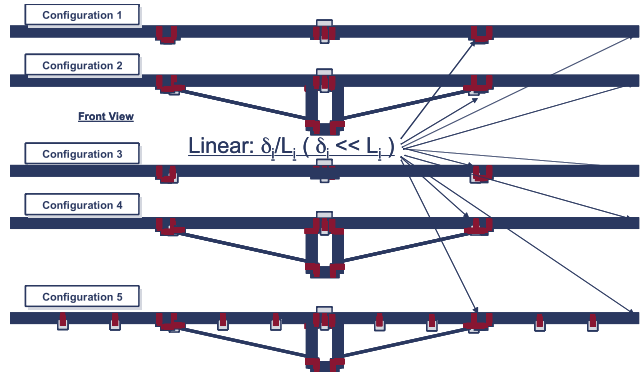


Figure 4b. Linear Deformation Constraints (Wing Assembly)

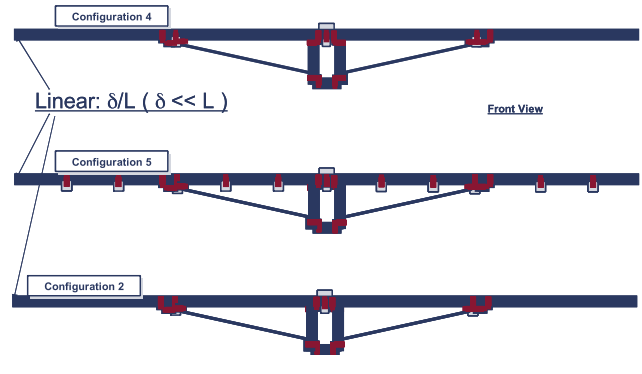


Figure 4c. Non-Linear Deformation Constraints (Wing Assembly)

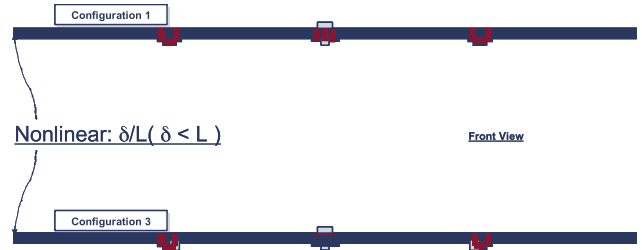




Figure 5a. Configuration 1; Maximum Deflection=29.20 in; Non-Linear Range δ/L ($\delta < L$)

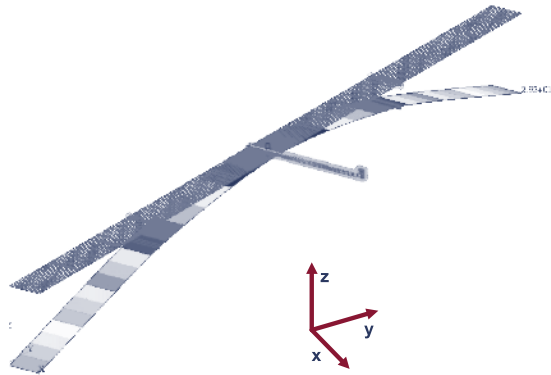


Figure 5b. Configuration 2; Maximum Deflection=6.16 in; Non-Linear Range δ/L ($\delta \ll L$)

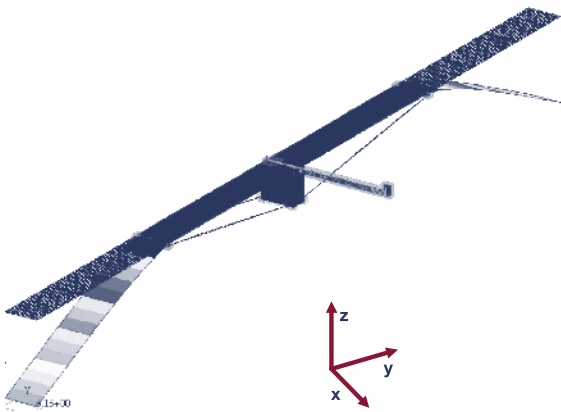


Figure 5c. Configuration 3; Maximum Deflection=30.50 in; Non-Linear Range δ/L ($\delta < L$)

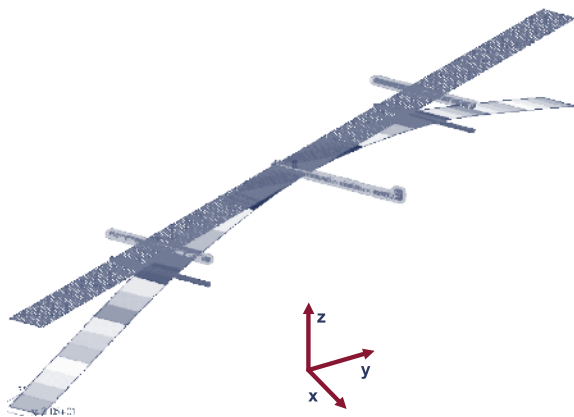


Figure 5d. Configuration 4; Maximum Deflection=5.16 in; Linear Range δ/L ($\delta \ll L$)

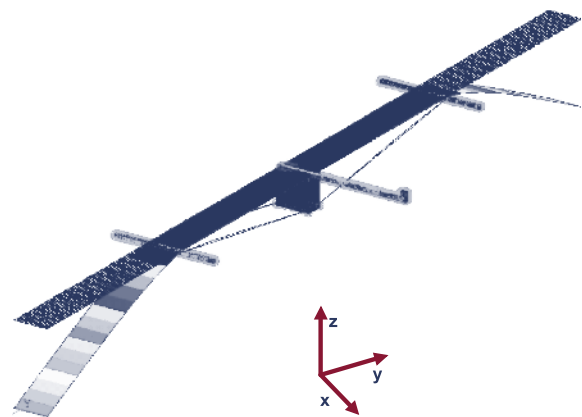


Figure 5e. Configuration 5; Maximum Deflection=6.55 in; Linear Range δ/L (L)

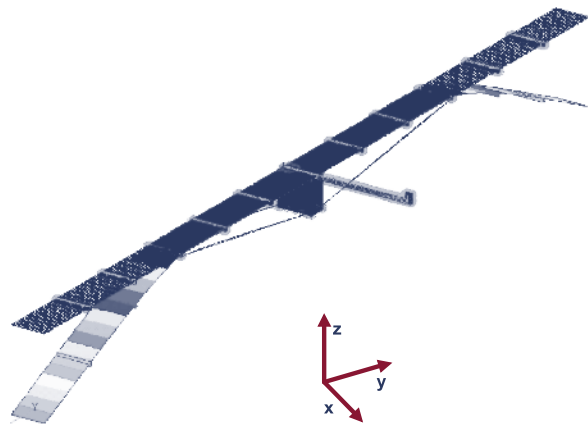
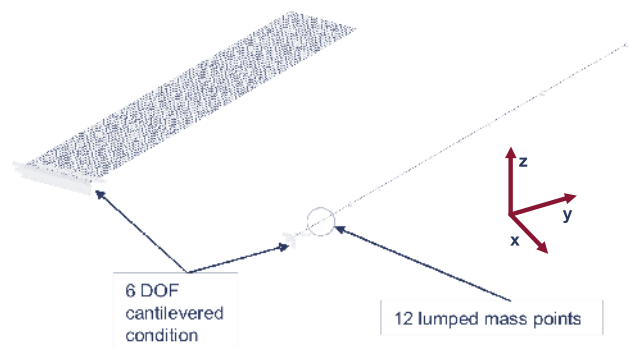
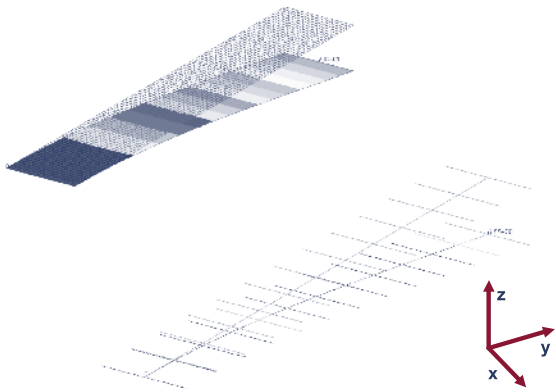


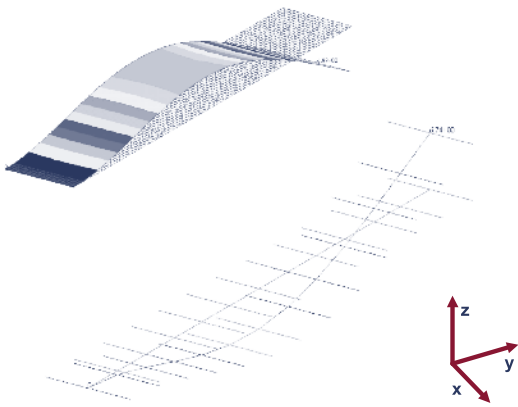
Figure 6. FEM and EBM for Right Outboard Wing



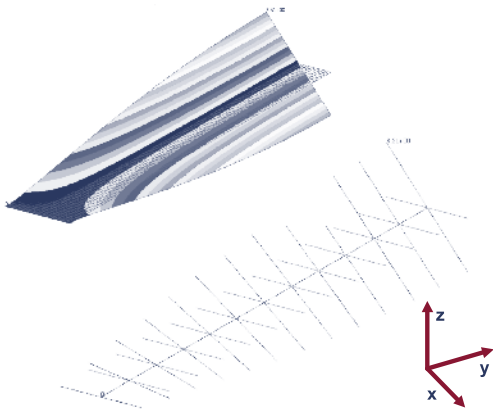
**Figure 7a. Mode 1 – First Vertical Bending;
Right Outboard Wing**



**Figure 7b. Mode 2 – Second Vertical Bending;
Right Outboard Wing**



**Figure 7c. Mode 3 – Torsion;
Right Outboard Wing**



**Figure 7d. Mode 4 – Third Vertical Bending;
Right Outboard Wing**

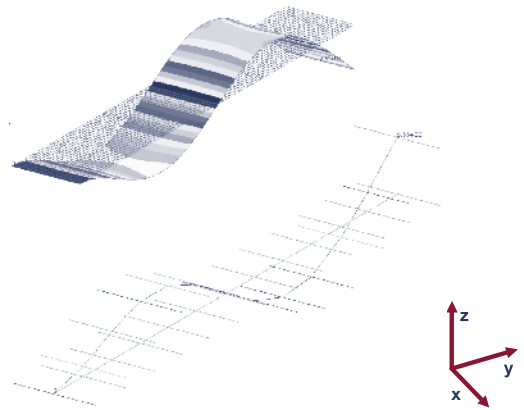
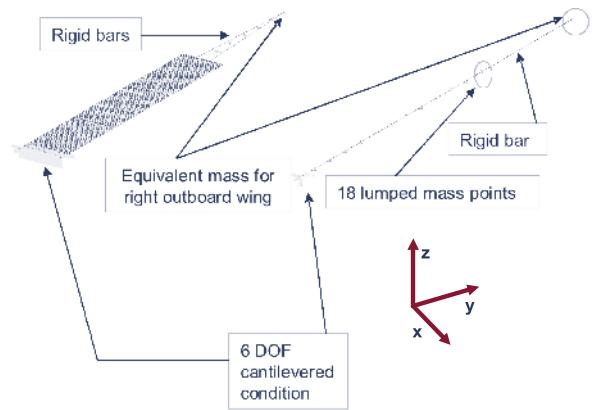
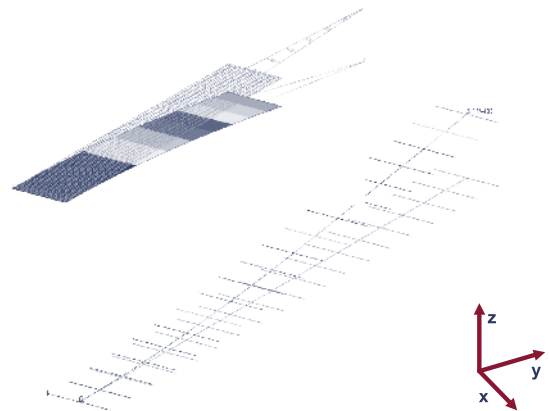


Figure 8. FEM and EBM for Right Inboard Wing

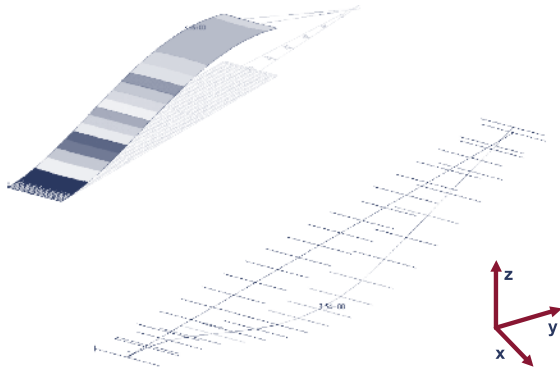


**Figure 9a. Mode 1 – First Vertical Bending;
Right Inboard Wing**





**Figure 9b. Mode 2 – Second Vertical Bending;
Right Inboard Wing**



**Figure 9c. Mode 3 – First Lateral Bending;
Right Inboard Wing**

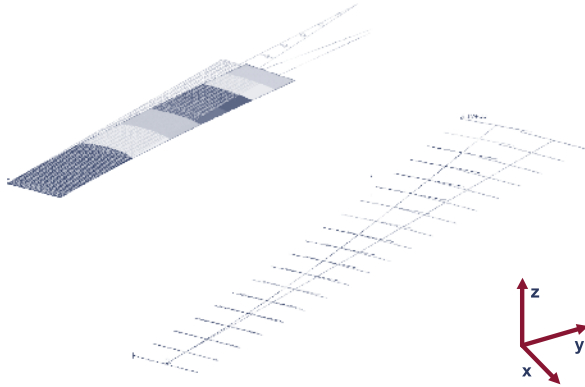


Figure 9d. Mode 4 – Torsion; Right Inboard Wing

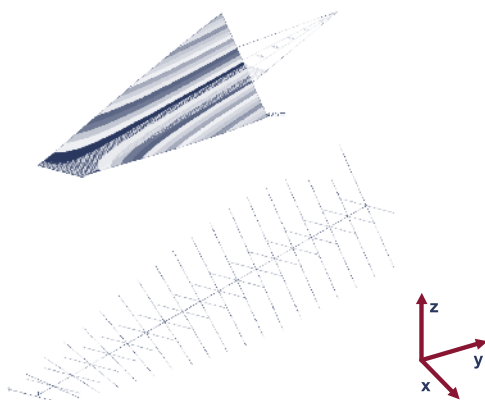
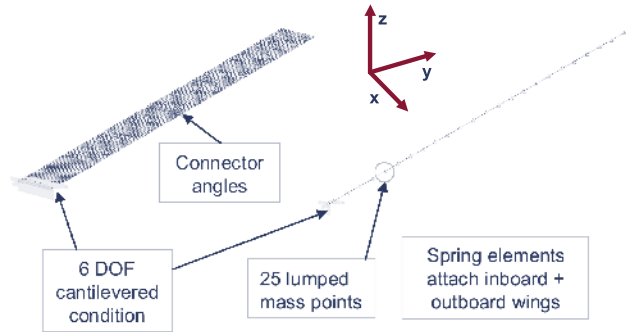
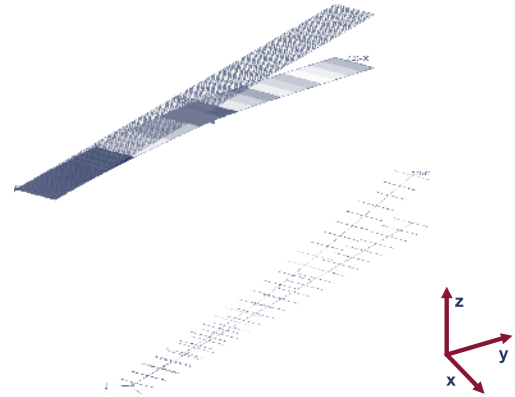


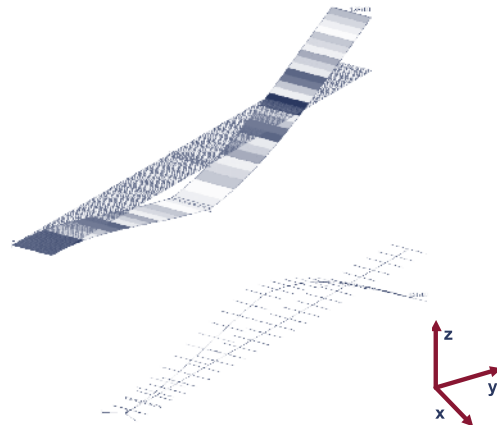
Figure 10. FEM and EBM for Entire Right Wing



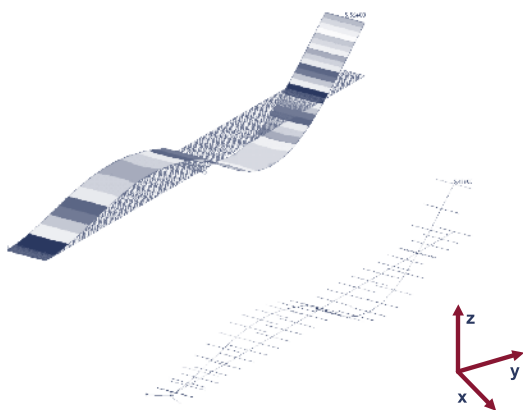
**Figure 11a. Mode 1 – First Vertical Bending;
Entire Right Wing**



**Figure 11b. Mode 2 – Second Vertical Bending;
Entire Right Wing**



**Figure 11c. Mode 3 – Third Vertical Bending;
Entire Right Wing**



**Figure 11f. Mode 6 – Fourth Vertical Bending;
Entire Right Wing**

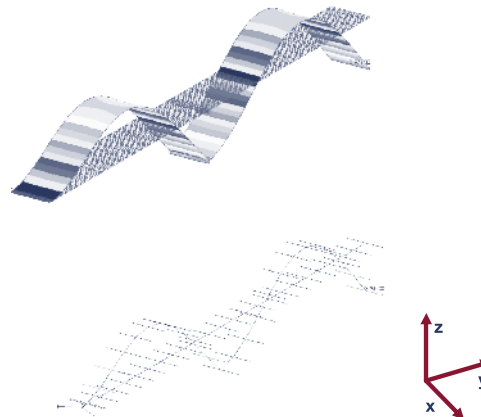
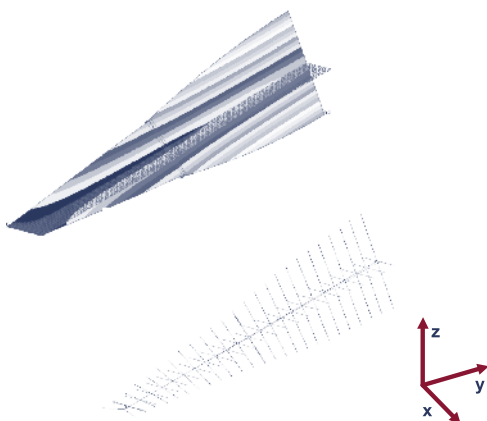
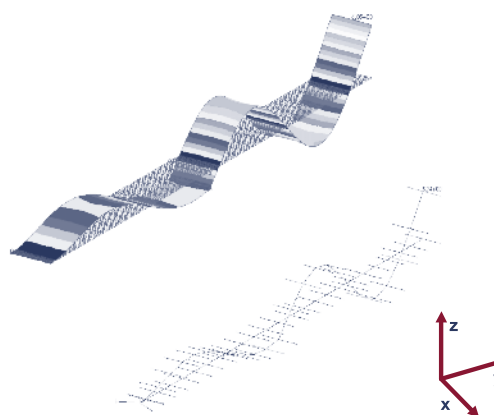


Figure 11d. Mode 4 – Torsion; Entire Right Wing



**Figure 11g. Mode 7 – Fifth Vertical Bending;
Entire Right Wing**



**Figure 11e. Mode 5 – First Lateral Bending;
Entire Right Wing**

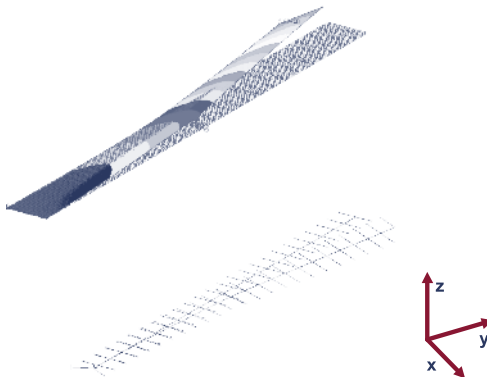
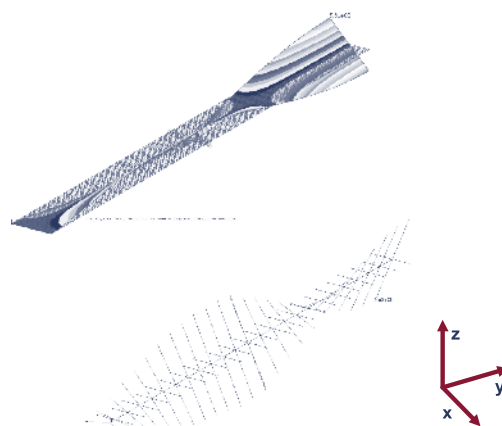
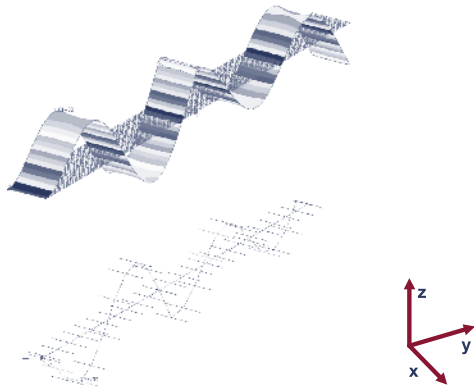


Figure 11h. Mode 8 – Torsion; Entire Right Wing

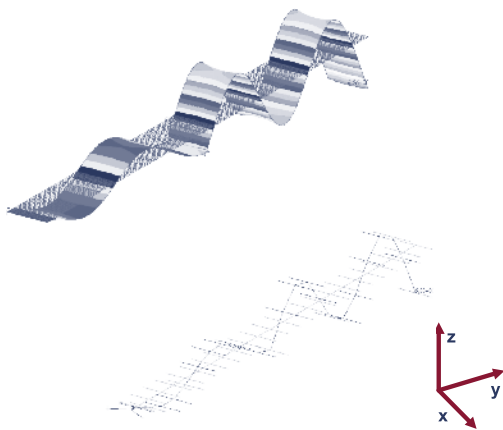




**Figure 11i. Mode 9 – Sixth Vertical Bending;
Entire Right Wing**



**Figure 11j. Mode 10 – Seventh Vertical Bending;
Entire Right Wing**



**Figure 12. FEM and EBM for Configuration 1
(Single Engine, Flexible)**

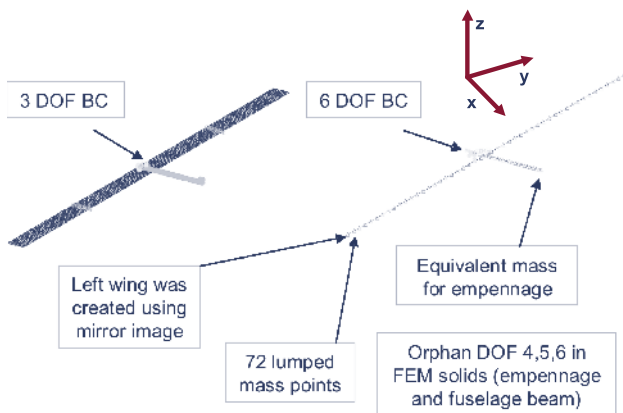


Figure 13a. Mode 1; Configuration 1

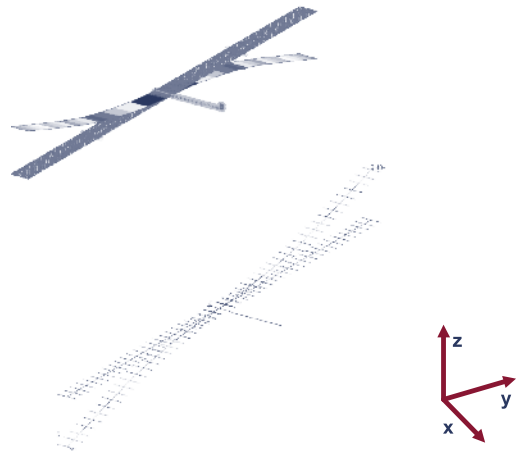


Figure 13b. Mode 2; Configuration 1

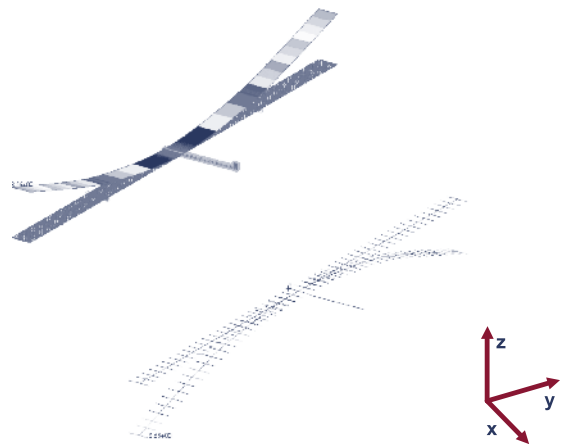


Figure 13c. Mode 3; Configuration 1

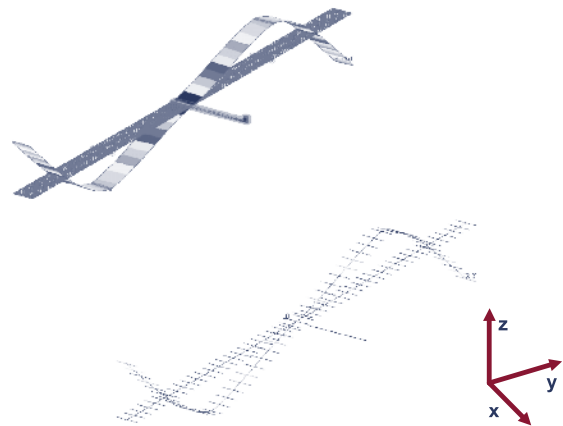


Figure 13d. Mode 4; Configuration 1

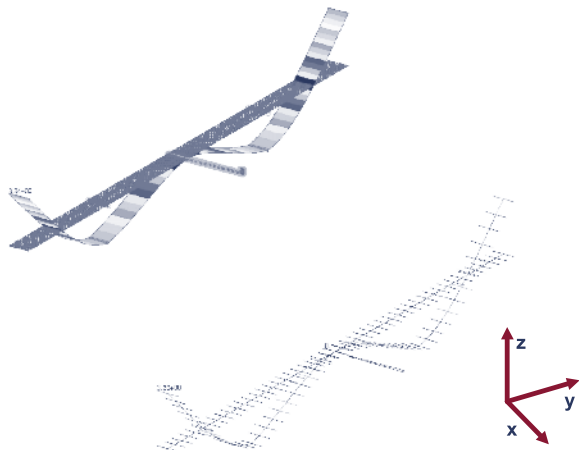


Figure 13g. Mode 7; Configuration 1

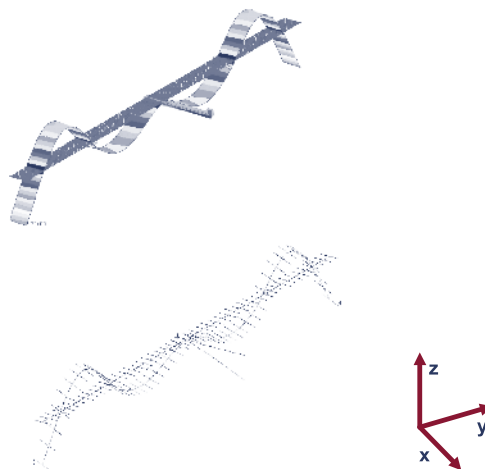


Figure 13e. Mode 5; Configuration 1

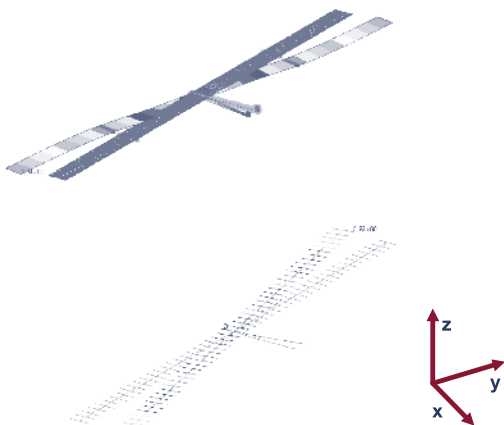


Figure 13h. Mode 8; Configuration 1

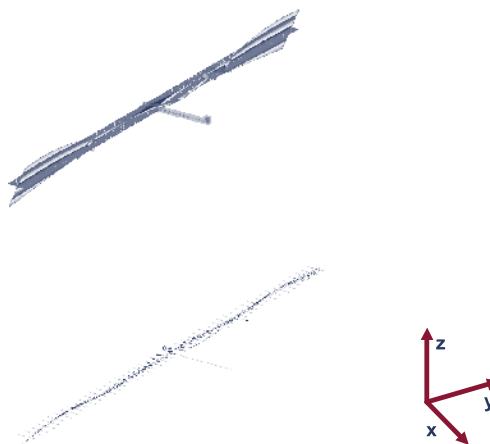


Figure 13f. Mode 6; Configuration 1

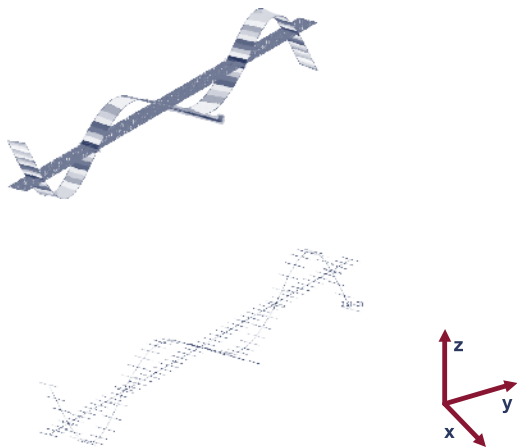


Figure 13i. Mode 9; Configuration 1

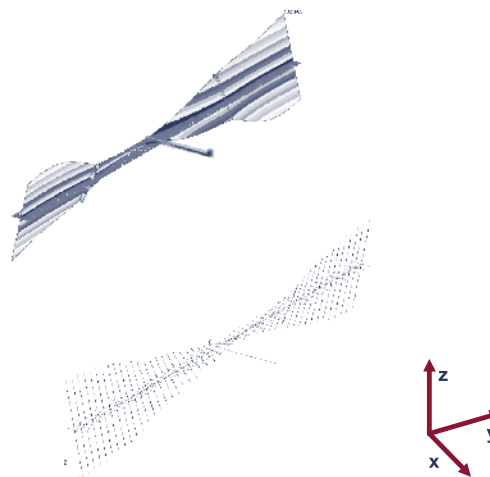




Figure 13j. Mode 10; Configuration 1

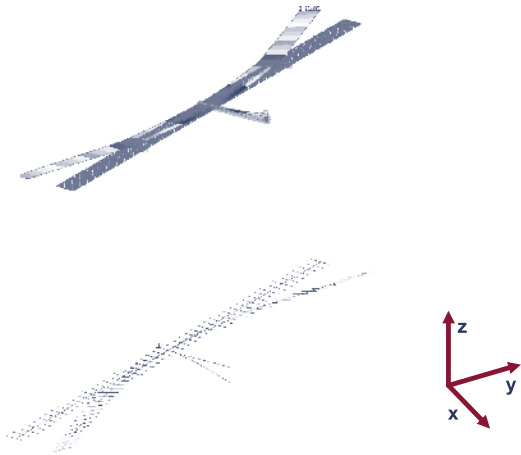


Figure 13m. Mode 13; Configuration 1

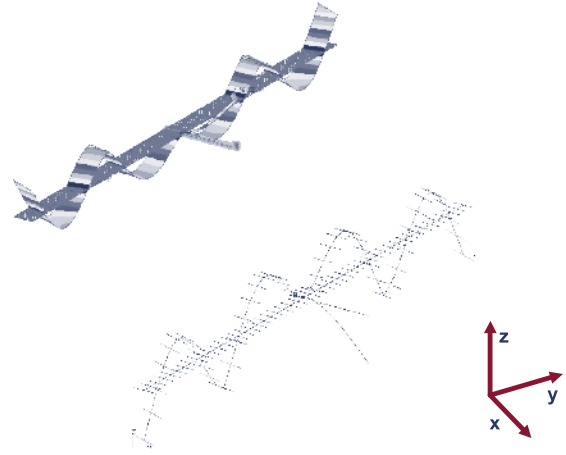


Figure 13k. Mode 11; Configuration 1

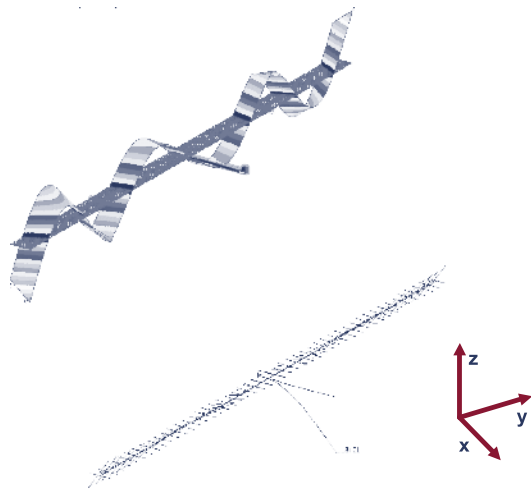


Figure 13n. Mode 14; Configuration 1

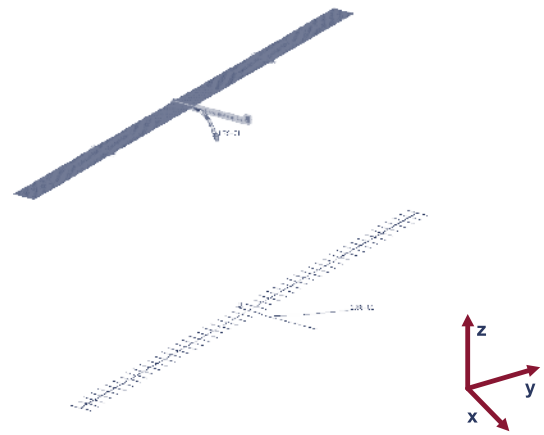


Figure 13l. Mode 12; Configuration 1

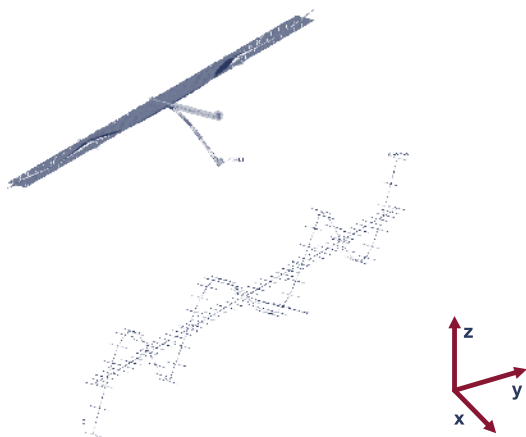


Figure 13o. Mode 15; Configuration 1

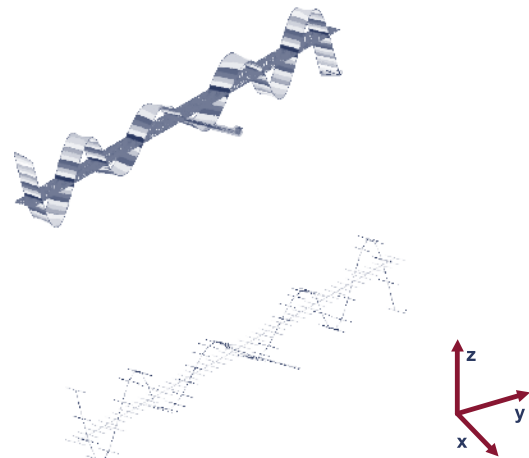




Figure 13p. Mode 16; Configuration 1

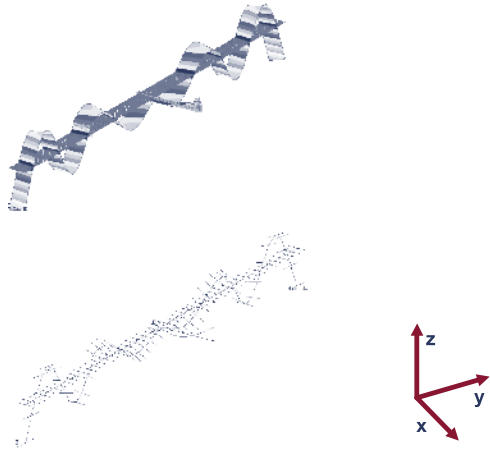


Figure 13s. Mode 19; Configuration 1

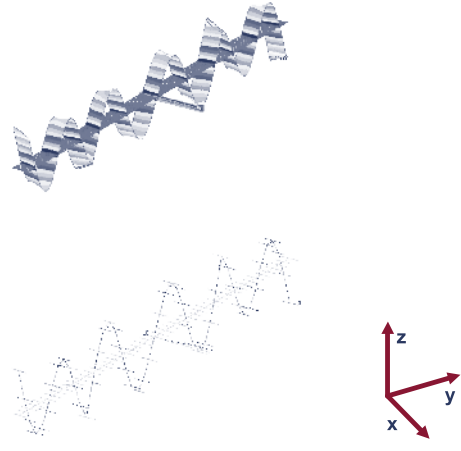


Figure 13q. Mode 17; Configuration 1

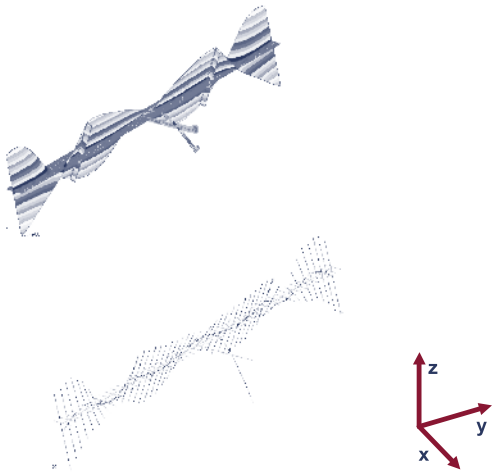


Figure 13t. Mode 20; Configuration 1

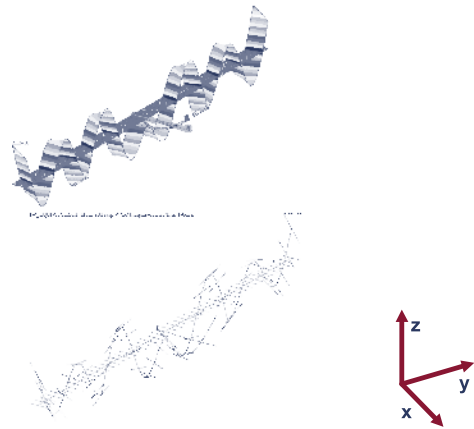
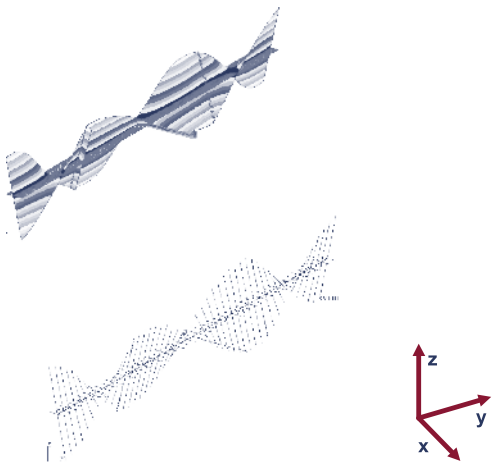


Figure 13r. Mode 18; Configuration 1





Kansas Bright Flight

VyTara Cross

McNair Scholar

Rhonda Lewis

McNair Mentor


"B

Abstract

right Flight," the out-migration of the college-educated young adults to other states, is a dilemma that leaves no state unscathed, including Kansas. The purpose of this research was to examine whether Kansas' young adults between the ages of 18 to 25 are actually leaving the state of Kansas. To address this notion, the Governor's office, Kansas African American Affairs Commission, and McNair Scholars Program faculty mentors and scholars at the University of Kansas, Kansas State University and Wichita State University joined together to form the Governor's Multicultural Research Council (MRC). Using a number of data sources such as the Board of Regents, Census Bureau, Department of Labor, and information from the offices of Institutional Research, Career Services, Alumni Association, Center for Economic Development and Business Research equivalents at each university, including government documents, the MRC found in their preliminary research that Kansas' educated young adults are in fact not leaving. The review of the data sources indicated that there are population shifts from rural to metropolitan areas, helping cities such as Wichita, KS to see a growth of more than two percent in its population. Perhaps the flight of the bright is not as prevalent as anecdotal information had suggested. Because data sources are fragmented and a systematic tracking of Kansas' educated young adults does not exist, the state should invest in a tracking system to document the flight its residents.

Kansas Bright Flight

Bright Flight, the out-migration of the college-educated young adults to other states, is a dilemma that leaves no state unscathed, including Kansas. Not unlike other states, Kansas leaders are concerned that after spending millions of dollars educating their young residents that they are losing them to other states, as anecdotal information suggests. To address the possibility of Kansas Bright Flight, the Governor's Office, Kansas African Affairs Commission, and McNair Faculty Mentors and Scholars at the University of Kansas, Kansas State University and Wichita State University joined together to form the Governor's Multicultural Research Council. Focusing on



three exit points (after high school, during college and after college), the purpose of this research study is to determine whether Kansas' young adults between the ages of 18 to 25 are actually leaving the state of Kansas.

Between 1995 and 2000, 75 percent of young, single and college-educated individuals changed their residence (Franklin, 2003), and research suggests this population moves because it can. Nowhere is the issue of Bright Flight more evident and actively addressed than in the state Maine. Like many states in the 1970's, Maine enjoyed a rise in population as a result of the baby-boom era. But, "since the 1980's, Maine has sustained a loss of 24.7 percent of youth aged 18 to 29, while the population aged 35-59 has grown by over 57 percent in the same time period" (Heminway, 2002). Among other things, to address this issue a suggestion of a "large longitudinal study" was made to help better understand this population. Prompting leaders to poll this particular population to find out why they are leaving. Before Kansas should poll its young adults as to why they are leaving, as anecdotal reports suggest, the notion of whether they are actually leaving has to be addressed.

A number of states are recognizing the impact that recent college graduates can have on a local economy, but there is little research dedicated to this specific demographic. *Migration of Recent College Graduates: Evidence from the National Longitudinal Survey of Youth*, by Yolanda Kodrzycki, is one of only a few surveys that specifically target this population. Kodrzycki examines the "cross-state migration in the five year period after completion of schooling" from 1979 to 1996. Comparing the migration patterns of recent college graduates to the general population, Kodrzycki's findings indicate that the college-educated are more likely to move than those without degrees. She found that their locations of choice are to the western and southern portions of the U.S, moving for "stronger economies or more attractive characteristics." The survey followed about 6,000 people varying in age from 14 to 22 year of age in 1979. The individuals were interviewed once a year until 1994. Information is not available for these individuals past 1996, when the interviewees were 31 to 39 years of age. Kodrzycki's longitudinal survey findings are considerable.

Between 1979 and 1996 Kodrzycki found that nearly 37 percent changed their state of residence after receiving bachelor degrees and 45 percent

with more advanced degrees. "By 1996, even greater numbers were located outside their home state: 35.1 percent of those who completed four years of college and 43.7 percent for those who had more than four years of college." These percentages indicate that with more education came more mobility. Though some of those surveyed may have attended state institutions in pursuit of their bachelors, the more advanced the degree the more likely the chance for migration.

Kodrzycki found that most location changes happen shortly after college graduation. Within one year of graduation about 30 percent were living in a different state than their high school and this number increased to 40 percent after six years. This presents the completion of college as a logical transition point. The presumption is that at this point individuals are starting careers and searching for other institutions to continue their educational pursuits. Within this six years after college graduation, graduates can pursue Master's and Doctoral degrees which could account for the 10 percent increase. Kodrzycki noted that after 10 years there was little variance in migration. This could indicate that these individuals have settled with their careers and family and have completed their educational pursuits, all of which would decrease the likelihood of migration.

The article *Migration of the Young, Single, and College Educated: 1995 to 2000*, by Rachel S. Franklin, attempts to look at the movement phenomenon among youth. Franklin examines the migration of the young as it relates to marriage and educational attainment. Franklin defines youth as "those between the ages of 25 and 39." Franklin also examines the importance of the young migration flow. According to Franklin, the "in-migration of young people, whether single or married, carries the potential of population growth through future childbearing. When the young people moving into an area are also college educated, they provide a measure of economic opportunity in the area, while simultaneously serving to raise the area's stock of human capital." Therefore, the young adult population can be of extreme importance and targeting the transience of the population in Kansas could serve to benefit the state.

These benefits are wide-ranging. Firstly, young, single and college-educated adults represented more than 80 percent of all moves between 1995 and 2000 to central cities. This population is extremely mobile



and its ability to rejuvenate economies is limitless. Secondly, “young, single and college-educated adults represented a higher proportion of people migrating to central cities than to the suburbs or non-metropolitan areas” (Franklin, 2004). If this population is moving, then their moving to Kansas could serve to benefit the state to changing Kansas into what Franklin calls a “migration magnet” or a city with a high net in-migration of young people. This change would positively influence not only the national perception but also the internal perception of the state. Conducting research would help to shed light on current movements of this population and thereby their perception of Kansas.

Overall, Kansas had a loss of approximately 5000 people who fit into the young, single, and college-educated category between 1995 and 2000. Kansas saw an in-migration of 11,250, but an out-migration of 16,275 people. “Young singles without a college degree living outside metropolitan areas were the least likely to have changed residence,” according to Franklin. The college degree was the largest contributor to the movement of young adults. Since the government invests millions of dollars annually to educate Kansans, it is important to know if this investment is in fact benefiting Kansas. Learning more about Kansas Bright Flight, could help to answer that question.

The census gives information on various topics, including migration. Marc J. Perry, in the article *State-to-State Migration Flows: 1995 to 2000* explores the movement of people within a state and cross-state using the information from the census. In 1990 all fifty states saw a population growth; however, some states lost an extreme amount of people. Kansas, for example, received a large influx of population from its neighboring state, Missouri. Approximately 53,622 people came to Kansas within 1995 to 2000 from Missouri. Similarly, Kansas lost 58,785 people to Missouri within the same time period.


Conducting Kansas Bright Flight research would help determine how many young Kansas-educated individuals may relocate to Missouri. If Kansas’ young adults are moving to Missouri, what are their reasons and what can be done to retain this population? These are questions that can only be answered if research of this population is possible.

The issue of Bright Flight has been a subject of discussion for quite some time. In an article, “Maine’s

Disappearing Youth: Implications of a Declining Youth Population,” by Merritt Heminway in 2002, Maine’s residents “aged 15-29 has been steadily declining throughout the 1980’s and 1990’s.” This trend has been of major concern to state leaders, and Maine appears to be the first to actively pursue a resolution to this growing problem. According to the article, the trend can be linked with declining birth rates, increase of youth out-migration, and a decrease of youth in-migration and when taken together they’ve created what the author has deemed “a near mirror image of the baby-boom phenomenon and anti-boom” (Heminway, 2002). An anti-boom that the author says will eventually devastate the state economically, educationally and culturally.

The article documents several factors that might lead to Bright Flight. First, Maine’s population has been falling since the 1960’s. Heminway relates the decrease of that to an “anti-babyboom” for the state. The state’s population is getting older and, increasingly less likely to have children. Secondly, out-migration has increased. In a survey of students in grade 6-12, the common belief was that in order to be successful one would have to leave the state. Maine is also the sixth largest exporter of college freshman. The belief system of the young threatens the future of Maine’s young adults. And finally, there was a decrease in in-migration. There were no economic incentives to attract young adults to the area. Housing and job markets are tight in Maine, which could deter any potential interest in the area. Knowing these issues contribute to Bright Flight in Maine generates many potential questions needing an answer in regards to Kansas. The demographics between the two states are different, but what are the general perceptions of Kansas (Wichita) and are they influencing our youths’ decisions to leave the state? Is Kansas’ economy influencing current residents to stay or enticing new residents to move to Kansas? These are all questions that need answering to solidify the need for Kansas Bright Flight research.

There are a number of implications associated with youth deciding to leave the state. First, as a result of the “anti-babyboom,” there could be a population gap left in the work force. As the middle aged population grows older and the young continue to leave, there will be no labor force available to fill jobs, and the state will become increasingly dependent upon



immigrant workers (Heminway, 2002). Secondly, the loss of a young population could lead to school consolidation. "From 1997 to 2009, Maine is expected to experience a 9 percent decline in public school enrollment" (Heminway, 2002). A decline in school-aged population will lead to educational funding cuts and future effects on university institutions in Maine. If Bright Flight persists in Maine, these implications are inevitable. If Bright Flight is an issue for Kansas, we could soon face the same issues.

Heminway recommended conducting a longitudinal survey of Maine's youth to determine why they were leaving. He suggests before Maine implements strategies to address this issue, policy makers might listen to young people and come up with solutions. But before Kansas should survey its youth population regarding Bright Flight, it is important to conduct research to establish whether or not Bright Flight should be a concern for Kansas.

Methods

Participant Setting

The participants were Kansas residents aged 18 to 25 and high school graduating seniors of 1998 through 2004, who attend Wichita State University. Wichita State University enrolls about 15,000 students a year. More than half of the student body is female and it is a non-traditional campus in that the average student age is 29 compared to college towns like Lawrence and Manhattan, Kansas.

Procedure

A number of existing data sources were examined to address the notion of Kansas Bright Flight. Three areas with high probability of loss were determined. These exit points include after *high-school*, a point at which many students move to enter the work force or college, *during college*, a point at which students may transfer to other universities or relocate for job opportunities, and finally, *after college*, a point when students join the work force or continue their education. For each exit point a number of data sources were used to examine the point at which Kansas may be losing its brightest students. A case study was also used to follow graduating high school seniors from the class of 1998 through 2004 of their college graduation year. A number of existing data sources were examined to address the notion of Kansas Bright Flight for each exit point.

Exit Point I: After High School

The first exit point is *after high school*. Information came from the state's Board of Regents, Kansas State Department of Education and government documents such as the Kansas Statistical Abstract. The Board of Regents tracks students who take the ACT and SAT in preparation for college. The Board of Regents also has a data collection system that tracks first-time student's financial aid use, determines where students are going and how many of these students left Kansas to attend out-of-state institutions as first time freshmen. Like the Board of Regents, the Kansas State Department of Education (KSDE) also tracks future college graduates. The KSDE surveys the educational ambitions of Kansas's high school students by district and county including demographic information, which helps to track the progress and intentions of high school students. There are also government documents that keep track of the "comings and goings" of Kansas' young population. For example, the Kansas Statistical Abstract tracks county, city and state education information. The ACT and SAT scores from the Board of Regents will provide some insight to the academic ambitions of Wichita's high school students. KSDE provides surveys on the student body about future academic intentions, and the Kansas Statistical Abstract provide demographic information on the premature academic exit of Kansas's young. Together these data sources will provide some detail of the educational intentions of Kansas' high school aged residents and more information on *after high school* as an exit point.

Exit Point II: During College

During college is the second exit point which is intended to follow Wichita State University's transient student body. For example, Wichita State's Office of Institutional Research is able to track the movements of WSU's student body because of its membership with the National Student Clearinghouse. Universities that are a part of the clearinghouse have access to student body information at the discretion of the subscribing university. This exit point will help identify the number of young Kansas residents leaving state institutions to attend those out-of-state or terminating their academic careers.



Exit Point III: After College

Finally, *after college*, the third exit point that attempts to find the migration patterns of those students who graduated from Wichita State University. The purpose of this exit point is to find where WSU's educated young adults are going. The Wichita State University Alumni Association has demographic and geographic information of its graduating seniors, who subscribe to an alumni magazine upon graduation, and existing active members. The Office of Career Services surveys graduating seniors, who have used services provided by the office, three months after graduation. It tracks graduates by their major, employment status and location and graduate school status and location. This provides information about what WSU graduates are doing after college, whether they are going to graduate school or entering the workforce. The US Census Bureau not only provides a number of articles regarding Bright Flight, but it also has information regarding the Kansas state population as it pertains to the movement of Kansas residents. When information from all of these data sources are combined, there will be more information regarding the migration patterns of WSU's graduates.

Case Study

The high-school graduating class of 1998 was chosen as a case study to represent the in and out-migration of Kansas youth. This class was chosen based on the notion that by 2004, a six year period from graduating high school, the majority of those, who entered college, would have graduated. As a result, information about this class can be examined at all three exit points as an effort to put Kansas Bright Flight in a comprehensible context to address the notion of this research paper: Are Kansas' young adults between the ages of 18 to 25 actually leaving the state of Kansas?

The University of Kansas and Kansas State University also used equivalent data sources available at their universities to help accurately depict Kansas Bright Flight at the state's three largest educational institutions. Each university requested information from every data source pertaining to each exit point. Requests were made for records extending as far back as five years specific to Kansas residents, demographic information was gathered when possible.


Major Findings

Addressing Kansas Bright Flight was no small undertaking. Once a list of data sources was determined, we solicited information pertaining to Kansas' young adult population in relation to the determined exit points at which it is most common for young adults to leave the state. The findings suggest that, contrary to anecdotal beliefs, Kansas may not be experiencing Bright Flight. For the most part, Wichita's young adult population may actually remain in the state upon the completion of their education. Their decision to do so could be linked to the non-traditional student body of Wichita State University. Bright Flight was also examined at the other universities participating in this project, the University of Kansas and Kansas State University, to better represent the issue of Bright Flight for the state of Kansas and the findings were interesting.

Exit Point I: After High School

Each year millions of high school graduates make decisions about their future. They spend months researching and applying to educational institutions or determining the best plan of action for their future, and students in Kansas are no exception. Like Kansas' students, many state institutions spend a large amount of time trying to determine the future plans of these individuals. From their first year of high school to their last, students' movements throughout the public educational system are examined by various organizations and when taken together they help to bring about a better understanding of graduating high school seniors.

According to the Kansas Department of Education, over 40 percent of high school seniors each year between the 1996 and 2004 reported plans to attend a four year college or university. Of the 1998 graduates in Wichita, over 1,100 students said they were college-bound, representing over half of the total graduating seniors in the city, and more than a third had intentions of pursuing formal education beyond high school. These findings show that high school seniors across the state have consistently had plans to further their education and students in Wichita are no different. Though the findings do not indicate whether these institutions are within the state, the value of education is evident.



The Kansas Statistical Abstract (2003) shows that though Wichita's students may value education, not every student completes their high school education. During the 2002-2003 academic year, over four-thousand students graduated within Sedgwick County, but during the same period over a thousand high school students dropped out of school. In relation to state numbers Sedgwick County's loss represented nearly a third of the state's dropout population for that academic year. The loss of students does not overshadow the accomplishments of nearly 35,000 high school students that year, but it is important to note.

The Board of Regents says 85 percent of Kansas students take the ACT, which is an indicator that they are staying in state. Due to academic preferences of institutions in different regions, 15 percent of Kansas students, those who take the SAT, would essentially have plans to attend universities out of state. The high percentage of students taking the ACT indicates that high school students are considering Kansas institutions when planning their academic careers.

The Midwestern Higher Education Compact (MHEC) followed first-time college freshman as they crossed state lines within one year of their graduation in 2002. According to the MHEC, Kansas exported nearly 15,000 first-time college freshman in 2002 and nearly half of them enrolled in institutions in Missouri. The interesting part, the largest number of students Missouri lost to any one state came to Kansas during the same year. As a result, Missouri lost nearly 100 students to Kansas. So for the most part, it appears that both state populations remained stable.

Considering this information, students in Kansas are planning to continue their education beyond high school, according to their preparation efforts. The interest in higher education is there and the pursuit can be implied.

Exit point II: During College

A number of students begin their college careers with every intention of completing their educational aspirations; however, during college is another point when decisions are made that could influence the "flight" of Kansas' educated minds.

In 2004, the Kansas Board of Regents reported information regarding the student body population at Wichita State University in the fall enrollment of 2002. The Board's headcount of the student population

was well over 15,000 and more than 50 percent of the student body was female and classified as full-time students. During the 2002-2003 academic year, the WSU Office of Institutional Research (OIR) was able to track those students enrolled in the fall of 2002 but did not re-enroll for the following semester, spring 2003.

Overall, OIR reported that WSU lost more than 1,500 students age 18 to 25. To determine the reason of departure, OIR used the National Student Clearinghouse to search for records of transfer students. The results, only 41 percent of the more than 1,500 students could be verified as transfer students to other educational institutions in the nation. The other 58 percent were made up of those that transferred to institutions that block information available to the Clearinghouse or college dropouts. Of the total number of students who did not return to WSU in the spring, 20 percent were minorities and records of transfer could not be found for nearly 60 percent of those minorities.

This information shows that WSU is only losing a small percentage of its student body; however, the reason for the loss cannot be fully determined. Wichita's retention of its educated population could be attributed to Wichita State University's largely non-traditional student body. These non-traditional students have jobs, families, and existing responsibilities that connect them to the community. As a result, the "flight" of the university's students is less likely than those of universities in "college towns," like the University of Kansas and Kansas State University.

Exit point III: After College

After college is another point at which the young and college-educated often decide to leave their state of residence. As they are offered jobs around the nation or they seek to further pursue post-graduate degrees, it is common for students to leave familiar cities in search of new surroundings and educational and career related opportunities, but is that the case for Wichita?

According to the Census 2000, Wichita was ranked the 160th metropolitan area to gain a population of young, single and college educated individuals between 1995 and 2000, with a loss of 377 young individuals. San Francisco placed first with a net immigration of nearly 50,000 people and Gainesville,



Florida came in last with a net out-migration of almost 7,500 people. The Census also found that between the same time period Kansas saw almost 55,000 residents from Missouri take up residence in the state of Kansas, but Kansas also lost just as many of its residence to Missouri. Though this information is not narrowed to those individuals age 18 to 25, the information suggests that Kansas may be “breaking even” when it comes to population shifts. The state is receiving just as many individuals as it is losing. It is also important to note that the percentage of the in-flowing and out-flowing population that is educated is unknown.

The Kansas Statistical Abstract (KSA) (2003) shows a 14.1 percent increase in the states population between 1990 and 2000. Within Sedgwick County there was a 20.1 percent increase with the county gaining nearly 5,500 people. The KSA also shows that between April 2000 and July 2003 Sedgwick County saw a growth in population of more than two percent. The map shows dramatic rural-to-metropolitan shifts throughout the state as counties like Greenley, located in the far west of the portion of the state, lost 7.43 percent, but Johnson County near the northeastern part of the state gained 7.76 in its population. This shows that Kansans are moving but they may only be relocating to other cities within the state.

Numbers show that 60 percent of Kansas State University’s 2004 graduates remained in Kansas after graduation. These numbers are nearly the same for Wichita State. The WSU Office of Career Services found that not only did 58 percent of the 2004 graduates who answered the graduate survey remain in Kansas for employment reasons, but 57 percent remained in the city of Wichita for educational and/or employment reasons. Not only could this retention be linked to the non-traditional student body of the university, but also the purpose of career services is to help prepare and connect students to career opportunities. If students already have jobs in the state before graduation, they might be less likely to leave.

Wichita State’s Alumni Association reported that 80 percent of the students graduating in 2004 remained in Sedgwick county or surrounding areas, a trend that has been on the rise for some time. Between 2000 and 2004, there was nearly a 17 percent decrease in the number of graduates who left the Wichita area upon graduation - another example of Wichita State graduates remaining in the area. This information was

not separated by those individuals age 18 to 25.

1998 Case Study

A case study was used to follow the graduating high school seniors from the class of 1998 through 2004 of their college graduation year. In the case of Kansas Bright Flight, anecdotal reports may have actually been misleading. After gathering all the information provided by three universities, the results appear to be opposite the beliefs of the general public.

Each university categorized their incoming class into three sections: those who graduated by 2004, continued their studies beyond 2004 and those who transferred from the university. At University of Kansas, 58.1 percent of the incoming class of 1998 graduated by 2004 and 4.5 percent continued their undergraduate studies beyond the allotted 6 year period. The remaining 37.4 percent whereabouts are unknown by the university. This study does not break the class into those students between the ages of 18 to 25.

In relation to the other universities it appears that Wichita State University is retaining its young adult population. Only 21.6 percent of the 1998 class was confirmed transfers to other universities through the National Student Clearinghouse. Though Wichita State only graduated 36.8 percent of the class by 2004 and 8.9 percent continued studies beyond 2004, that continuation is not an uncommon act by the Wichita State student body. The university has almost as many part-time students as it does full-time. The university’s student body is largely “non-traditional” and due to family, financial and personal responsibilities, it is not uncommon for Wichita State students to take one class at a time as opposed to the other two universities that have large “traditional” study populations. The Wichita State study was limited to only those students age 18 to 25, so the study is not taking into consideration the entire class of 1998.

Information from Kansas State University was not available in time for the completion of this research paper.

This study hopes to show the transience of students at each of the three major universities in Kansas. The differences in movement could be directly related to the difference in the universities student body demographics and metropolitan area.

Discussion

Overall, Wichita's young adult population appears to be staying. Though there is some attrition, research suggests that transience is not uncommon for this population, it is almost expected. What separates Wichita State from the other universities participating in this research is the difference in student body; Wichita State has a large non-traditional population, which could be the reason for retention. Given that this is preliminary research, future research would be needed to examine why this appears to be the case in Wichita.

This research in large part does not compare to that of Maine. As assumptions as to why Maine's youth were leaving the state were made and surveys of the youth population were suggested, there were no reports of as an extensive research of archival information as what was the case for the Kansas Bright Flight Project. The Governor's Multicultural Research Council targeted the possible exit points at which Kansas' young adults could be leaving the state and as a result of our research there is now more information about this population than was available before. Maine has not done such research. As Maine is the sixth largest exporter of college freshman, their focus may be more so on student's intentions after high school. Maine is losing it's youth, and though anecdotal reports suggests that Kansas is too, archival information regarding the movement of the states population refutes these reports.

In relation to the three exit points, our knowledge of the state's young adults has greatly increased. We know that students are planning for their future while in high school as a result of surveys by institutions like the Kansas Department of Education. We now know that Wichita State's non-traditional student body could be what keeps our students in the area after graduation. We know that a pursuit of further education after college and employment within the community appears to keep students in the Wichita area as over half of students who answered Career Services 2004 survey reported. Wichita's educated population appears to be staying and Bright Flight appears to not be of major concern in this area.

Limitations

In conducting research, a number of limitations were encountered. As our research relied heavily on archival data, there were limitations in regards

to available information. Often there was a variance in the definition of "young adult." For this project, young adults were defined as those age 18 to 25, but other sources classified young adults anyone between 25 and 39. Information was either generically separated as 25 and above or fragmented in sub sections, such as 15 to 19 or 20 to 24. These variances made it difficult to target our population. For example, the Kansas Statistical Abstract reported more than a two percent population increase between 2000 and 2003, but the percentage of that population classified as "educated" is not available. Oftentimes information was available for both population and age but there was a variance in the time frame in which the reports were documented. Initially, demographic information was solicited from each data source but sometimes information was not available. It is also important to note that data collection was totally dependent upon volunteerism which also posed problems as information was collected.

Recommendations

As for the future, there may be a need to survey this particular population's "belief system" as it pertains to Kansas as done in Maine with children in grades six through 12. There may also be a need for a systematic tracking system to target young adults in Kansas. It could be a collaborative effort between state institutions and organizations that have a stake in the retention of this population for varying purposes. Future research is also encouraged to help determine if Kansas' young adults are actually staying in the state.

Taken together, it appears that Bright Flight is not as significant a problem in Wichita as some thought. Given that the state spends millions of dollars each year to educate its youth an investigation in the above mentioned recommendations would be beneficial large in part because current data sources in Kansas provide insufficient information to adequately answer the question regarding Bright Flight.

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Determination of Relative Binding Preference of Uranyl Ion for Nitriles, Ketones and Amides

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o determine by tandem mass spectrometry the preference of the uranyl ion for various nitrile, ketone and amide ligands. Electrospray ionization will generate uranyl ion complexes containing a mix of nitriles, ketones, or amides. The class of nitriles will include acetonitrile, propionitrile, butyronitrile and benzonitrile. The class of ketones will include acetone, 2-butanone, 2- and 3-pentanone and hexanones. The class of amides will include acetamide, propanamide and 4-methoxybenzamide and dimethylformamide. The types of ligands expelled during a collision induced dissociation sequence, and the normalized collision energy required, will provide information of the preferred ligand. A survey of these ligands will be completed.

Abstract

Introduction

Little research has been done on the intrinsic nature of uranyl ion in the gas-phase; while much study has been completed on the cation in the aqueous phase. Aqueous uranium, U, and thorium, Th, have been detected along with other aqueous actinides in seawater, fresh surface waters and groundwaters.¹ Uranyl, UO_2^{2+} , a cation of sustained interest, is known to attach to a number of ligands in the aqueous phase,² but little is known about behavior in the gas-phase. Species behavior in solution may vary from gas-phase as a result of the solvents' participation in the reaction. Studies in the gas-phase allow us to evaluate active species which are too transient in solution and to determine binding preference of uranyl ion for the functional groups, amides, ketones, and nitriles.³

Previous investigations in the gas-phase include mass spectrometry research focused on U in low oxidation states, U^+ , UO^+ and oxidation reactions with organic compounds. Studies have also been conducted on oxidation reactions by small molecules such as O_2 , CO, N_2O and ethylene oxide. Gresham, et al. produced uranium oxo cations by sputtering solid UO_3 by ReO_4^- ; for study on hydration rates by Ion Trap Mass Spectrometry (ITMS). Kemp, et al. generated uranium oxo cations along with some of higher uranium oxidation states from dioxouranium salts using fast atom bombardment. Schwarz, et al actually generated the "bare uranyl dication by gas-phase oxidation." Van Stipdonk, et al generated ions containing U in the higher



oxidation states and has focused on multiple-state collision-induced dissociation (CID) of coordinated uranium dioxo cations to observe uranyl's acceptance or expulsion of the functional groups as neutral ligands in the gas-phase.⁶

Experimental Details

ESI Solution. Preparation of spray solutions for electrospray ionization (ESI) involved mixing 500

μL of 1mM uranyl and deionized water in a 1:1 ratio. The uranyl was purchased from Fluka/Sigma-Aldrich (St. Louis, MO) and used promptly. This solution was mixed with 250 μL of 1mM of respective classes of amides, ketones and nitriles, also purchased from Fluka/Sigma-Aldrich and promptly used.

The spray voltage was set at 5.0 and the flow rates on the syringe pump were set at 5 μL/min. Table 1 lists the uranyl-amide, uranyl-ketone and uranyl-

Table 1. Mass-to-Charge Ratios, Chemical Composition of Uranyl Complexes Generated by ESI.

Amides					
Acetamide (aca)		Propanamide (prop)		4-Methylbenzamide (4mba)	
m/z	Composition	m/z	Composition	m/z	Composition
135	UO_2^{2+}	135	UO_2^{2+}	135	UO_2^{2+}
194.1	$[\text{UO}_2(\text{aca})]^{2+}$	185.6	$[\text{UO}_2(\text{prop})]^{2+}$	210.6	$[\text{UO}_2(4\text{mba})]^{2+}$
194.1	$[\text{UO}_2(\text{aca})_2]^{2+}$	236.2	$[\text{UO}_2(\text{prop})_2]^{2+}$	286.2	$[\text{UO}_2(4\text{mba})_2]^{2+}$
223.6	$[\text{UO}_2(\text{aca})_3]^{2+}$	286.7	$[\text{UO}_2(\text{prop})_3]^{2+}$	361.7	$[\text{UO}_2(4\text{mba})_3]^{2+}$
232.6	$[\text{UO}_2(\text{aca})_3(\text{H}_2\text{O})]^{2+}$	295.7	$[\text{UO}_2(\text{prop})_3(\text{H}_2\text{O})]^{2+}$	370.7	$[\text{UO}_2(4\text{mba})_3(\text{H}_2\text{O})]^{2+}$
241.6	$[\text{UO}_2(\text{aca})_3(\text{H}_2\text{O})_2]^{2+}$	304.7	$[\text{UO}_2(\text{prop})_3(\text{H}_2\text{O})_2]^{2+}$	379.7	$[\text{UO}_2(4\text{mba})_3(\text{H}_2\text{O})_2]^{2+}$
253.1	$[\text{UO}_2(\text{aca})_4]^{2+}$	337.3	$[\text{UO}_2(\text{prop})_4]^{2+}$	437.3	$[\text{UO}_2(4\text{mba})_4]^{2+}$
253.1	$[\text{UO}_2(\text{aca})_4(\text{H}_2\text{O})]^{2+}$	346.3	$[\text{UO}_2(\text{prop})_4(\text{H}_2\text{O})]^{2+}$	446.3	$[\text{UO}_2(4\text{mba})_4(\text{H}_2\text{O})]^{2+}$
282.7	$[\text{UO}_2(\text{aca})_5]^{2+}$	387.9	$[\text{UO}_2(\text{prop})_5]^{2+}$	521.9	$[\text{UO}_2(4\text{mba})_5]^{2+}$
Ketones					
Dimethylformamide (dmfa)		Acetone (ace)		2- & 3-Pentanone (pent)	
m/z	Composition	m/z	Composition	m/z	Composition
135	UO_2^{2+}	135	UO_2^{2+}	135	UO_2^{2+}
171.6	$[\text{UO}_2(\text{dmfa})]^{2+}$	193.1	$[\text{UO}_2(\text{ace})_2]^{2+}$	221.1	$[\text{UO}_2(\text{pent})_2]^{2+}$
208.1	$[\text{UO}_2(\text{dmfa})_2]^{2+}$	222.1	$[\text{UO}_2(\text{ace})_3]^{2+}$	264.2	$[\text{UO}_2(\text{pent})_3]^{2+}$
244.7	$[\text{UO}_2(\text{dmfa})_3]^{2+}$	231.1	$[\text{UO}_2(\text{ace})_3(\text{H}_2\text{O})]^{2+}$	273.2	$[\text{UO}_2(\text{pent})_3(\text{H}_2\text{O})]^{2+}$
253.7	$[\text{UO}_2(\text{dmfa})_3(\text{H}_2\text{O})]^{2+}$	240.1	$[\text{UO}_2(\text{ace})_3(\text{H}_2\text{O})_2]^{2+}$	282.2	$[\text{UO}_2(\text{pent})_3(\text{H}_2\text{O})_2]^{2+}$
262.7	$[\text{UO}_2(\text{dmfa})_3(\text{H}_2\text{O})_2]^{2+}$	260.2	$[\text{UO}_2(\text{ace})_4(\text{H}_2\text{O})]^{2+}$	316.26	$[\text{UO}_2(\text{pent})_4(\text{H}_2\text{O})]^{2+}$
281.2	$[\text{UO}_2(\text{dmfa})_4]^{2+}$	280.2	$[\text{UO}_2(\text{ace})_5]^{2+}$	350.3	$[\text{UO}_2(\text{pent})_5]^{2+}$
290.2	$[\text{UO}_2(\text{dmfa})_4(\text{H}_2\text{O})]^{2+}$				
317.8	$[\text{UO}_2(\text{dmfa})_5]^{2+}$				
Nitriles					
2-Butanone (but)		2- & 3-Hexanone (hex)		Acetonitrile (acn)	
m/z	Composition	m/z	Composition	m/z	Composition
135	UO_2^{2+}	135	UO_2^{2+}	135	UO_2^{2+}
207.1	$[\text{UO}_2(\text{but})_2]^{2+}$	235.2	$[\text{UO}_2(\text{hex})_2]^{2+}$	155.5	$[\text{UO}_2(\text{acn})]^{2+}$
243.2	$[\text{UO}_2(\text{but})_3]^{2+}$	285.2	$[\text{UO}_2(\text{hex})_3]^{2+}$	176	$[\text{UO}_2(\text{acn})_2]^{2+}$
252.2	$[\text{UO}_2(\text{but})_3(\text{H}_2\text{O})]^{2+}$	294.2	$[\text{UO}_2(\text{hex})_3(\text{H}_2\text{O})]^{2+}$	196.5	$[\text{UO}_2(\text{acn})_3]^{2+}$
261.2	$[\text{UO}_2(\text{but})_3(\text{H}_2\text{O})_2]^{2+}$	303.2	$[\text{UO}_2(\text{hex})_3(\text{H}_2\text{O})_2]^{2+}$	205.5	$[\text{UO}_2(\text{acn})_3(\text{H}_2\text{O})]^{2+}$
288.3	$[\text{UO}_2(\text{but})_4(\text{H}_2\text{O})]^{2+}$	344.3	$[\text{UO}_2(\text{hex})_4(\text{H}_2\text{O})]^{2+}$	214.5	$[\text{UO}_2(\text{acn})_3(\text{H}_2\text{O})_2]^{2+}$
315.4	$[\text{UO}_2(\text{but})_5]^{2+}$	385.4	$[\text{UO}_2(\text{hex})_5]^{2+}$	217	$[\text{UO}_2(\text{acn})_4]^{2+}$
		226	$[\text{UO}_2(\text{acn})_4(\text{H}_2\text{O})]^{2+}$		
		237.5	$[\text{UO}_2(\text{can})_5]^{2+}$		
Butyronitrile (acn)		Propionitrile (acn)		Benzonitrile (acn)	
m/z	Composition	m/z	Composition	m/z	Composition
135	UO_2^{2+}	135	UO_2^{2+}	135	UO_2^{2+}
204.1	$[\text{UO}_2(\text{but})_2]^{2+}$	190	$[\text{UO}_2(\text{pn})_2]^{2+}$	238.1	$[\text{UO}_2(\text{bzn})_2]^{2+}$
238.7	$[\text{UO}_2(\text{but})_3]^{2+}$	217.5	$[\text{UO}_2(\text{pn})_3]^{2+}$	289.7	$[\text{UO}_2(\text{bzn})_3]^{2+}$
247.7	$[\text{UO}_2(\text{but})_3(\text{H}_2\text{O})]^{2+}$	226.5	$[\text{UO}_2(\text{pn})_3(\text{H}_2\text{O})]^{2+}$	298.7	$[\text{UO}_2(\text{bzn})_3(\text{H}_2\text{O})]^{2+}$
256.7	$[\text{UO}_2(\text{but})_3(\text{H}_2\text{O})_2]^{2+}$	235.5	$[\text{UO}_2(\text{pn})_3(\text{H}_2\text{O})_2]^{2+}$	307.7	$[\text{UO}_2(\text{bzn})_3(\text{H}_2\text{O})_2]^{2+}$
273.2	$[\text{UO}_2(\text{but})_4]^{2+}$	245	$[\text{UO}_2(\text{pn})_4]^{2+}$	341.2	$[\text{UO}_2(\text{bzn})_4]^{2+}$
282.2	$[\text{UO}_2(\text{but})_4(\text{H}_2\text{O})]^{2+}$	254	$[\text{UO}_2(\text{pn})_4(\text{H}_2\text{O})]^{2+}$	350.2	$[\text{UO}_2(\text{bzn})_4(\text{H}_2\text{O})]^{2+}$
307.8	$[\text{UO}_2(\text{but})_5]^{2+}$			392.8	$[\text{UO}_2(\text{bzn})_5]^{2+}$

nitrile complexes generated. The temperature was maintained at 200°C.

Mass Spectrometer. Electrospray ionization (ESI), mass spectra was collected using a Finnigan LCQ-Deca ion-trap mass spectrometer (ThermoFinnigan Corporation, San Jose, CA). The instrument was tuned to maximize uranyl complex ion intensities. Ion trapping isolation periods ranged from 1-5,000 μ -seconds. The collision energy was set to the point that the precursor ion intensity was <10% of the total ion abundance.

Data Manipulation. Raw data was collected from the mass spectrometer using Excaliber™ software. Filtering and plotting of the data was performed in Find Ion Software™ and the exported to MS Excel™ for final graphing and analysis.

Results

We based our results on chemical mass shift data, ion peak shapes, and plotting fractional ion abundance vs. ion desolvation temperature. In Figure 1, data along the 'x' axis represents the molecular mass of the complex ion over charge, m/z , the charge of the cation being '2', as demonstrated in Table 1. The chemical mass shift data was determined by the differences

between ion peaks and the molecular weight variance of the coordination compounds produced. Results were magnified by Zoom Scan, which provides high-resolution mass spectra for intensified observation of each complex ion. Significant peaks occur at 246.5, 248 and 249.5 as indicated in Figure 1. These peaks represent mass differences in the complex ions of $[\text{UO}_2^{2+}(\text{act})_1(\text{pn})_3]^{2+}$, $[\text{UO}_2^{2+}(\text{act})_2(\text{pn})_2]^{2+}$, $[\text{UO}_2^{2+}(\text{act})_3(\text{pn})_1]^{2+}$, as the ligands fracture and rebind.

Data from the 'y' axis represents ion peak intensity related to the most abundant peaks. The greater the R. I., the greater the fractional abundance %, then the more favorable the reaction. Figure 2 elucidates the species eliminated in each reaction. In Figure 2a, it took almost 100 % R.I. to dissociate the propionitrile, while it took only 50% to dissociate the acetone ligand. In Figure 2b, again it took almost 100% R.I. to dissociate the propionitrile ligand and only 10% to dissociate the acetone ligand. Figure 2c, dissociated the propionitrile ligand at 100% again, and in this instance the acetone did not even bind.

Conclusion

Based on chemical mass shift data, ion peak shapes, and plotting fractional ion abundance vs. desolvation

Figure 1. ESI mass spectrum of uranyl complex ions generated with ZoomScan intensification.

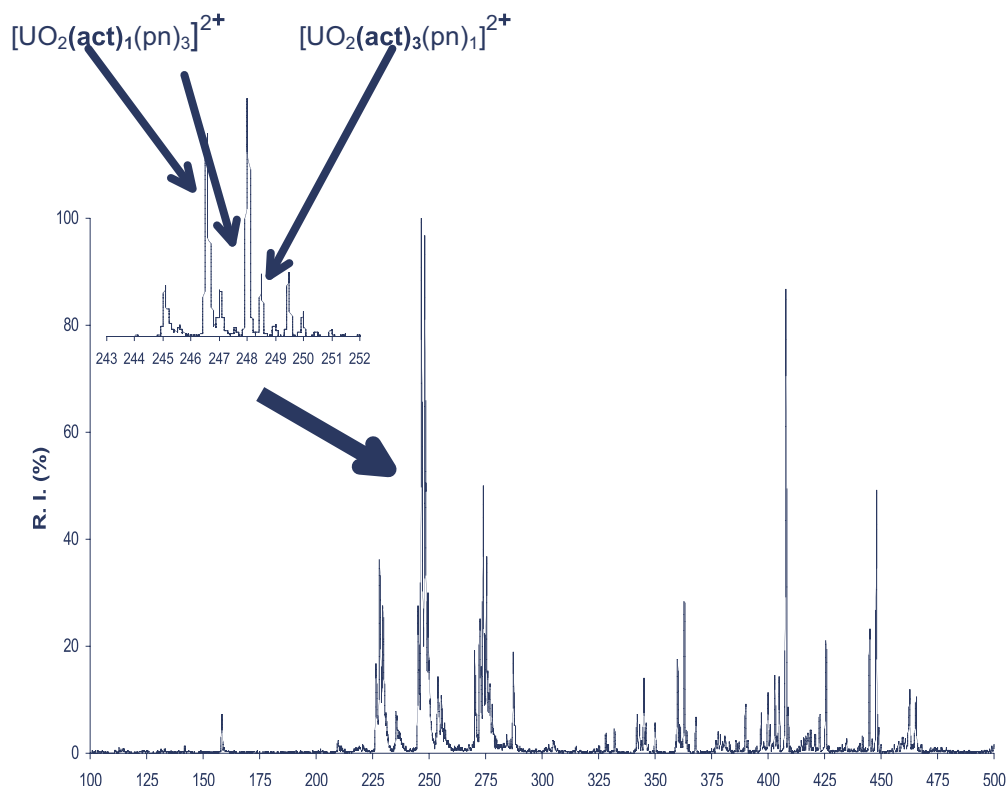
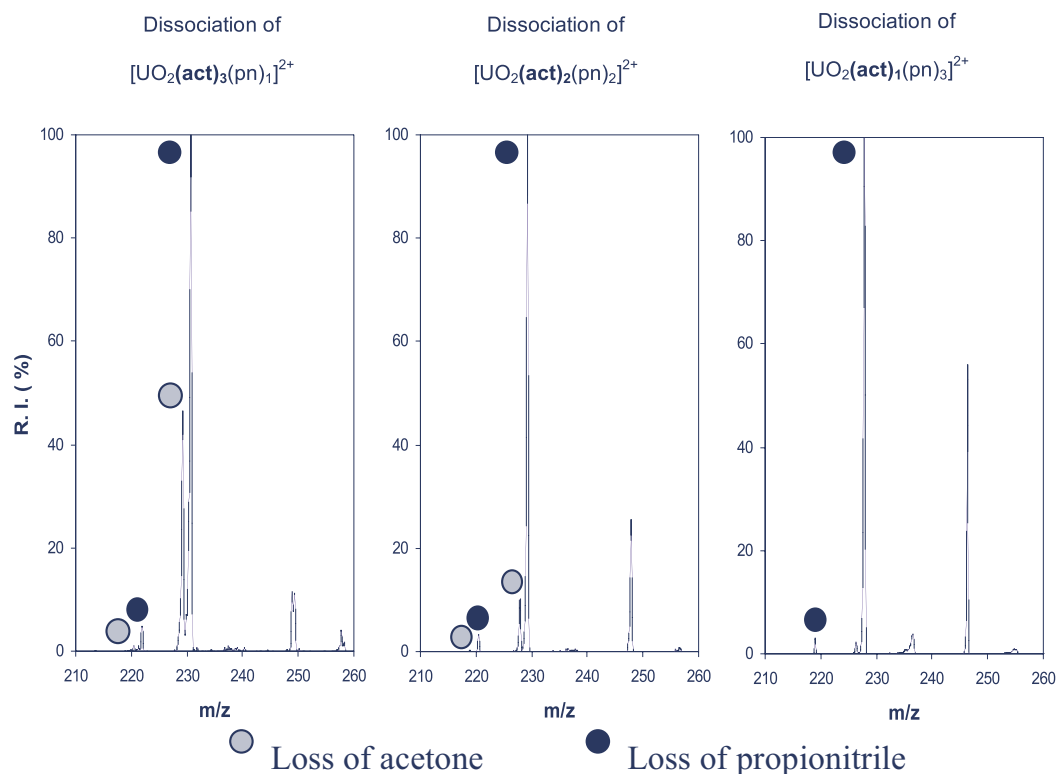




Figure 2. Ion peak intensity necessary to dissociate observed ligands.



temperature there is evidence suggesting that in the gas phase, and under ion-trapping and ejection conditions, the uranyl cation exhibits a binding preference to the ketone ligand, acetone, over the nitrile ligand, propionitrile. Similar experiment's spectra not shown here, suggest in the gas-phase, the uranyl ion ultimately exhibits an even stronger binding preference to amides over both ketones and nitriles.

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Investigating the Relationship Between Amount of Exercise and Incidence of Addictive and/or Obsessive Compulsive and Narcissistic Personality Traits

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Abstract

he relationship between different exercise groups and specific personality characteristics was investigated. A total of 145 participants took part in the study. All participants completed the Personal Experiences Questionnaire, which consisted of 123 items total. Of those items, ten pertained to the exercise category of the participant. The remaining items were randomly assigned in a forced-choice true/false format that were designed to access characteristics of narcissistic personality, addictive personality, and obsessive-compulsive personality. Four groups of exercisers were derived from the data gathered: nonexercisers, moderate exercisers, intense exercisers, and competitive bodybuilders. No significant differences were found among the four groups of exercisers on the previously mentioned personality variables, which conflicts with findings from other studies that have documented elevated levels of narcissism among competitive bodybuilders. Bodybuilders participating in this project, however, were significantly older than the other three groups of exercisers and bodybuilders evaluated in other studies, suggesting that the psychological functions served by bodybuilding may vary by age.

Investigating the Relationship Between Amount of Exercise and Incidence of Addictive and/or Obsessive Compulsive and Narcissistic Personality Traits

The degree to which individuals exercise may vary from not at all to the extreme of competitive bodybuilding. What motivates one individual to choose to participate as a competitive bodybuilder while another individual may choose not to participate in any type of exercise program? One possible way to address this question is to examine personality characteristics of individuals who engage in various amounts of exercise. The purpose of this study was to further pursue this approach.

At least two studies have investigated personality characteristics of bodybuilders. In the first of these studies, Darden (1971) administered a widely used personality inventory (16 PF; Cattell, Eber, & Tatsuoaka, 1970) to bodybuilders and weightlifters and concluded that they were "...alike and quite normal or average in their personality profiles." More recently, Rubinstein (2003) has researched another personality



variable that may distinguish bodybuilders, namely narcissism. Narcissism is commonly thought of as self-love, but can be conceptualized as including all of the following characteristics:

Grandiose sense of one's self-importance; preoccupation with fantasies of unlimited success, power, brilliance, beauty or ideal love; exhibitionism; responds to criticism, indifference or defeat either with cool indifference or with marked feelings of rage, inferiority, shame, humiliation, or emptiness; entitlement, expecting special favors without assuming reciprocal responsibilities; exploitativeness; relationships vacillate between the extremes of over idealization and devaluation; and lack of empathy (Raskin & Hall, 1979, p. 590).

Rubinstein found that bodybuilders showed an elevated level of narcissism compared to a nonexercising control group.

The occurrence of addictiveness and obsessive-compulsiveness among different exercise populations have also been an area of interest in previous research. Davis, Katzman, and Kirsh (1999) examined addictive and obsessive-compulsive personality characteristics exhibited by patients with anorexia nervosa. In this population of adolescents, addictive and obsessive-compulsive personality characteristics "significantly predicted" obligatory attitudes toward exercise.

Examining narcissism, addictive, and obsessive-compulsive personality characteristics between different groups of exercisers may help us to understand what purpose exercise might serve among these different groups. For example, if it is shown addictiveness is a component that increases with the level of exercise, the potential to introduce exercise as a healthy option to less desirable addictive behaviors such as drug abuse may exist. Similarly, if the function of narcissism and obsessive-compulsive personality is better understood as it applies to exercise, this knowledge may be useful in promoting exercise more broadly to increase the health of the general population.

This study assessed differences in levels of narcissism, addictiveness, and obsessive-compulsiveness among groups of individuals engaged in various levels of exercise. It was hypothesized that the competitive bodybuilders would show elevated levels of these personality variables relative to the other groups of exercisers.

Methods

Participants

A total of 145 participants took part in this study. The participants were divided into subgroups according to reported levels of exercise. Of the 145 participants, 21 were male competitive bodybuilders. These competitive bodybuilders were accessed at a bodybuilding competition in St. Louis, Missouri. The remaining participants were members of local gyms or students enrolled in an introductory psychology course at Wichita State University. Participants who reported exercising for at least four days per week and at least one hour per exercise session were identified as intense exercisers. This group consisted of 53 total participants, 32 male participants and 21 female participants. Moderate exercisers were identified as those participants who reported exercising less than three days per week with each exercise session lasting less than one hour. There were a total of 37 participants in this group, 16 male participants and 21 female participants. Nonexercisers consisted of participants who reported they did not currently participate in an exercise program. This group had a total of 39 participants, 19 male participants and 20 female participants.

Materials

Participants completed a Personal Experiences Survey consisting of 123 total items. The first ten items were used to assess background information. These items determined gender, age, and level of exercise and thus the subgroup membership (competitive bodybuilder, intense exerciser, moderate exerciser, or nonexerciser) of each participant. The remaining 113 items consisted of items developed to assess narcissism, addictiveness, and obsessive-compulsiveness, presented in a forced-choice (true/false) format. These items were randomly assigned to avert possible detection of the personality characteristics being assessed.

Narcissism: Items from the Narcissistic Personality Inventory (NPI) developed by Raskin and Hall (1979) were used to obtain a total score on level of narcissism for each group of exercisers. Examples of the 39 items found on the NPI include "People always seem to recognize my authority," "I really like to be the center of attention" and "I like to display my body" (Raskin & Terry, 1988).

Addictiveness: Levels of addictiveness were measured using 32 items derived from an ‘addiction scale’ (A-Scale) developed by Gossop and Eysenck (1980). Anxiety, depression, and a willingness to reject social values were among some of the items measured by the A-Scale (Gossop & Eysenck). Items found on the A-Scale include “Would you call yourself a nervous person?” “Have you ever taken advantage of someone?” and “Does your mood often go up and down?”

Obsessive-Compulsiveness: The final measure of personality assessed levels of obsessive-compulsiveness taken from the ‘obsessional factor’ developed by Lazare, Klerman, and Armor (1970). Examples of the 42 questions from this measure of personality include “I take pride in my ability to control my emotions,” “I organize my daily activities so that there is little confusion,” and “I find that I enjoy work more than relaxation.”

Procedure

Participants were instructed to complete the survey in its entirety and return it upon completion. The completed surveys were then scored by the researcher using a master score key in a random manner as to assure the anonymity of the data gathered from the participants.

Results

The use of analysis of variance (ANOVA) determined there were no significant differences among the four groups on levels of narcissism, addictiveness, and obsessive-compulsiveness. Tables one through three provide descriptive statistics for each one of the personality variables, as well as gender and age composition for each of the four exercising subgroups.

TABLE 1
Level of Addictiveness between Groups

	Gender	N	Mean Age	Mean	Std. Deviation
Nonexercisers	Male	19	22.90	9.16	4.11
	Female	20	20.30	8.90	4.92
Moderate	Male	16	26.19	10.94	4.75
	Female	21	29.62	9.76	4.94
Intense	Male	32	29.31	8.66	4.40
	Female	21	29.19	10.43	4.64
Competitive	Male	21	40.76	9.00	4.90
	Female	0	-	-	-

TABLE 2
Level of Obsessive-Compulsiveness between Groups

	Gender	N	Mean Age	Mean	Std. Deviation
Nonexercisers	Male	19	22.90	25.16	4.29
	Female	20	20.30	22.50	4.97
Moderate	Male	16	26.19	25.81	5.17
	Female	21	29.62	23.43	5.33
Intense	Male	32	29.31	26.60	5.80
	Female	21	29.19	24.86	7.25
Competitive	Male	21	40.76	27.00	6.30
	Female	0	-	-	-

TABLE 3
Level of Narcissism between Groups

	Gender	N	Mean Age	Mean	Std. Deviation
Nonexercisers	Male	19	22.90	21.63	7.07
	Female	20	20.30	20.35	6.10
Moderate	Male	16	26.19	24.38	5.44
	Female	21	29.62	17.71	8.50
Intense	Male	32	29.31	22.56	5.70
	Female	21	29.19	23.57	8.45
Competitive	Male	21	40.76	23.05	8.50
	Female	0	-	-	-

Discussion

The results of the present study indicate the level of exercise is not related to levels of addictive personality, obsessive-compulsive personality, and/or narcissistic personality characteristics. These findings do not support the original hypotheses which predicted competitive bodybuilders would show increased levels of all three personality variables. These findings also contradict those of previous research such as Rubinstein (2003) which found elevated levels of narcissism among bodybuilders he studied.

There may be several explanations for the lack of differences among the groups examined. Perhaps the most likely explanation to why no difference was found between the competitive bodybuilders in comparison to the other groups of this study may have been due to the age of the bodybuilders. The average age of the competitive bodybuilders in the present study was almost 41, whereas the average age of all other groups was just over 26 which is comparable to the age of the bodybuilders in Rubinstein’s study (25). Another possible explanation for the lack of



significant findings may involve social desirability. That is, some participants despite the anonymity of the study may have indicated that they took part in an exercise program when they may not have, thereby minimizing any differences among the groups being compared.

Finally, while the present study utilized all items found on the NPI, Rubinstein (2003) used a small subset of items from the NPI. Additionally, the bodybuilders in the present study were competitive American bodybuilders, whereas the bodybuilders in Rubinstein's study were non-competitive and Israeli, suggesting bodybuilding may serve different psychological functions within different cultures.

One possible limitation of the present study is only three personality variables were investigated. Areas of future research may include examining additional personality variables that may vary across different exercising subgroups. It may be useful to determine underlying personality variables that may contribute to the commitment of the exerciser. Understanding these personality variables may afford the opportunity to promote exercise as a healthy alternate to other less desirable behaviors (substance abuse), as well as a means of improving physical well-being more generally.

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An Examination of Video Game Usage and Awareness of Ratings

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Due to technological advances, the video game sector is currently the fastest growing entertainment industry. The future wave of video games to be released on the next generation console such as PlayStation 3, Xbox360, and Revolution are incredibly realistic with images approaching motion picture quality. With these new games, it is no longer easy to distinguish between reality and fiction. Of significant concern is the popularity of military and crime video games, which attract younger teenagers at an impressionable age. Considering the burgeoning growth of these games and the vulnerability of the individuals who are playing them, questions arise concerning the effects of these games on the players. This study focuses on awareness of game ratings and if the individuals who buy them are aware of what the ratings are and what they mean. Additionally, this study examines the amount of use; types of games played; and differences between males and females in their use of games. To investigate these issues, a survey was designed and administered to 70 participants. The results of the survey indicated that most participants (a) were not aware of the ratings of the video games; (b) had played military or crime video games; (c) indicated games with females portrayed as the main characters as heroes are not as popular as those with males as heroes; and (d) reported females spent less time than males playing video games, and females preferred nonviolent games. The results of this study will be used to design future video game experiments at Wichita State University.

Abstract

An Examination of Video Game Usage and Awareness of Ratings

The history of video games date back to the 1970s; however, it was not until the 1990s that video games became popular entertainment (Leonard Herman, Jer Horwitz, Steve Kent, Skyler Miller, 2002). In 1995, the rise of the 32-bit Sony PlayStation marked an end of a 16-bit game console Nintendo-dominated era. Unlike the predecessors, video games began a new transformation from 2D hand-drawn sprites into 3D computer-generated polygons. The introduction of the CD-ROM also marked the end of the once popular game cartridges. The world of video games continued to evolve with the new 128-bit generation



of video game consoles when Sega introduced their Dreamcast in 1999, and when Sony introduced their PlayStation 2 in 2000. Further, Nintendo and Microsoft followed their competitors with GameCube and Xbox the following year (Leonard Herman, Jer Horwitz, Steve Kent, Skyler Miller, 2002).

It is undeniable that currently the video game sector is the fastest growing entertainment industry. According to Screen Digest, a consultant company, global sales of video game software were approximately \$20 billion in 2004 and now exceed box-office receipts. Video games' popularity has skyrocketed thanks to technological advances. Even with the current generation of video games on PlayStation 2, Xbox and GameCube, games are already nothing like their predecessors; however, the game industry will not stop there. By the end of this year, Microsoft will debut their next generation console, Xbox360, to the market. Furthermore, Sony will debut their PlayStation 3 in Spring 2006, and Nintendo will follow with their own Revolution. Graphics in these new generation video games will be startlingly realistic, with images approaching motion picture quality.

Given that millions of players are playing video games, it is certain that not all games are suitable for all ages. Some games are created specifically for mature audiences and are not meant for children. The concern for children and improper use of video games has resulted in considerable discussion on violent games and their effects on player's behavior. As a result, video game research has burgeoned in recent years. Many universities such as the University of Missouri and Iowa State University have conducted studies to address these matters. Studies from these universities suggested that there is a relationship between children viewing violent video games and violent behavior (Anderson & Dill 2000).

In 1994, with the release of *Mortal Kombat*, video games shocked politicians and the media by the level of violence contained in them. It was confirmed at the time these violent games were not suitable for children to play. Since then, the Entertainment Software Rating Board (ESRB) was established to rate games and to inform players and parents about the contents of the games.

Considering violent events in society such as the Columbine High School shootings, in which the

perpetrators were known users of video games, raises concerns about the use of violent video games and its relationship to teenage violence. For these reasons, it becomes critical that players and parents are aware of the content of video games and are informed of the ESRB ratings. Regulations are there to protect the players and to regulate video games; however, users and their parents need to be aware of the regulations and ratings and understand what they mean. The ratings serve to provide needed information regarding the content of the video games.

This study is exploratory research in which the goal was to gather baseline data that focused on awareness of video game ratings. We investigated whether individuals who buy video games are aware of the ratings and what they mean. Additionally, this study examined the amount of video game use; types of games played; most popular games; and differences between men and women in the use of video games.

Methods

Participants

This study involved 70 participants (47 female and 23 male) with ages ranging from 18 to 52 and an overall mean age of 24.90 (see Table 1). Fifty-one participants reported single status, and 19 reported marital status. Seventeen indicated they were parents. The majority of the participants were from four undergraduate psychology classes in Wichita State University, while others were randomly selected students and their parents. Participation was voluntary and confidential.

Table 1. Participant demographic

	Participants	Single	Married	Parents
Males	23	19	4	4
Females	47	32	15	13
Total	70	51	19	17

Procedures

This study was approved by the Institutional Review Board at Wichita State University. The participants completed a consent form and were informed that their participation in the study was voluntary and confidential. The survey took approximately fifteen minutes to complete. After the surveys were collected, the data was entered into a database and checked for frequency and central tendency.



Materials

All participants were asked to complete a confidential survey, which was designed on a Likert scale and contained items that focused on four questions:

1. Will participants be familiar with the ESRB ratings and know the ratings of the games they have played?
2. What will participants indicate are the most popular games to play?
3. Are games which portray females as heroes as popular as games which portray males as heroes?
4. Will female participants prefer nonviolent games and spend less time playing video games than male participants?

Results

Question 1: Will participants be familiar with the ESRB ratings and know the ratings of the games they have played?

The results revealed that 55.7 % of our participants did not know what the ESRB ratings were. Of the participants, 24.3 % reported having an average knowledge about the ratings, and only 8.6% reported having a good knowledge about the ratings. None of the participants reported knowing the ratings perfectly. Although 44.3% of the participants reported knowing about the ESRB ratings, only 11.4% of the participants were able to identify the ESRB ratings for their top five favorite video games.

Question 2: What will participants indicate are the most popular games to play?

The selections for military, crime, and violent video games in this study were Grand Theft Auto, Devil May Cry, Halo, Doom 3, God of War, Mortal Kombat, Manhunt, Hitman, Shadow of Rome, SOCOM, Medal of Honor, Call of Duty, Black Hawk Down, Battlefield 1942, Conflict Desert Storm, Full Spectrum Warriors, Counter Strike, Rainbow Six and Half Life 2. These games were chosen because they fit the military, crime and violent category. They were known to be popular and widely known in the gaming community. Of the total participants, 71.4% reported that they had played at least one of these games before. Table 2 shows the top games that the participants had played: Grand Theft Auto (50%), Mortal Kombat (40%), Halo (27.1%), Medal of Honor (17.1%), Doom 3 and Counter Strike (12.9%).

Table 2. Popular games

	Game	Percentage of participants played
1.	Grand Theft Auto	50%
2.	Mortal Kombat	40%
3.	Halo	27.1%
4.	Medal of Honor	17.1%
5.	Doom 3	12.9%
5.	Counter Strike	12.9%

The results revealed that 10% of the participants played games one to three hours per week; 10% played four to six hours per week; 1.4% played six to ten hours per week; and 4.3% played more than ten hours per week. Participants who played more than ten hours per week listed one of these games as their most favorite: Diablo 2, Counter Strike, Medal of Honor, Halo 2. Overall, 37.1% of the participants reported listed Grand Theft Auto or games with military, crime, or gore contents in their list of five most favorite games.

Question 3: Are games which portray females as heroes as popular as games which portray males as heroes?

When asked whether the participants had played games in which the main character was a female, 45.7% reported playing at least one game in the past. Table 3 shows that 12.9% had played 2 to 3 games, and 2.9% had played more than 3 games. Overall, 65.6% of those who reported playing heroine video games did not play more than two violent games from the selections of military, crime, and violent games in this study.

Table 3. Games portrayed female as heroes

	Percentage of participants played
1 game played	45.7%
2 to 3 games played	12.9%
More than 3 games played	2.9%

The selections for games with females portrayed as the main characters as heroes were Beyond Good and Evil, Wild Arms 3, Primal, Rumble Roses, Drakan: The Ancient's Gates, BloodRayne, Tomb Raider, and Nightshade. These games were chosen because they were the most widely known in the community for their leading female characters. Our results revealed that Tomb Raider was the only popular game in the selections, as 27.1% of the participants reported playing it. The next contenders were Drakan: The Ancient's Gates and Beyond Good and Evil with only 5.7%.



Question 4: Will female participants prefer nonviolent games and spend less time playing video games than male participants?

The results revealed that female participants reported spending less time playing video games than male participants. A total of 84.09% of the female participants reported playing games less than 1 hour per week. The favorite game played by females was Tetris, while the favorite game played by males was Grand Theft Auto.

Discussion

Considerable key points were derived from the study. First, this study found that 44.3 % of the participants knew about the ESRB ratings; however, only 11.4 % of the participants were able to identify the ESRB ratings for their top five favorite video games. These findings suggested that perhaps with the controversy surrounding video games in recent years, participants may have heard about the ESRB ratings of video games; however, they failed to identify game ratings for their five favorite video games. The participants' responses indicated they had heard about the ESRB ratings, but did not understand the details of the ESRB.

Second, we found that even in a limited study, Grand Theft Auto and other games with military and violent contents were popular. Grand Theft Auto was reported as the most popular game. Of the participants, 50% reported they had played Grand Theft Auto before; and 37.1% of the participants listed Grand Theft Auto or games with military, crime, or gore contents in their list of five favorite games. Also important to mention were the games Mortal Kombat and Halo. Mortal Kombat has a long series with many sequels on several different video game consoles. This may explain why 40% of the participants reported they had played Mortal Kombat. As for Halo, its third place ranking in the study provided clues as to why this game has remained the number one, most popular military/shooting game on Xbox.

Third, our results indicated that games which portrayed females as heroes were not as popular as games which portrayed males as heroes. The results indicated that Tomb Raider was the only popular game with the female as hero, as 27.1% of the participants reported they had played Tomb Raider. The participants indicated their second favorite games

were Beyond Good and Evil and Drakan with only 5.7%. These results indicate that other than Tomb Raider, games with females as heroes were not widely known and were not as popular as games with males as heroes.


Finally, the main differences between males and females playing video games were that female participants played games less than male participants. The type of games played by females and males also differed. The favorite game played by females was Tetris and the favorite game played by males was Grand Theft Auto. Further, when comparing male and female participants' responses, the females reported they were most likely to play nonviolent games, while males reported they were most likely to play violent games.

Limitations

One of the limitations of this study was that the majority of the participants were selected from summer psychology classes, which may not be generalized to the general population of Wichita State University. This study may have been more conclusive if a variety of participants from different majors such as engineering and computer science would have been included. In these particular fields, students' interest in programming games or playing video games may be higher. Another limitation of the study was there were fewer male participants than there were female participants. Also, the information from the survey involved participants' self reports, which may have led to inaccurate data.

Future Research

Future research could include examining other interesting topics such as the differences between female players versus male players, the psychological attractions of popular video games, and the online/multi-player experiences. Additionally, future research regarding the level of violence in the contents of the games is needed. Further, of substantial concern is video games have taken players to another level and instead of playing alone against the computer, players can now communicate and play along with other players around the nation or the world. In military games, this creates an ultimate virtual reality war zone in which the players can feel the intensity and adrenaline of fighting in combat. Significant



consideration should be given to the effects of these games and the attitudes toward aggression and war. Given the ongoing popularity and escalating levels of violence of video games, further research is warranted.

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Incorporating Emotional Intelligence into Undergraduate Classrooms

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ne objective of post-secondary education is to develop professionals who are successful leaders in their careers. An academic minor combining personal development and leadership skills could contribute greatly to the success of university graduates when they reach the workplace. Daniel Goleman's findings in the areas of emotional intelligence and leadership skills could be one way to incorporate leadership development into the current college curriculum. Emotional intelligence is directly linked with outstanding leadership, and Goleman's *Primal Leadership* gives a comprehensive model for professional leadership skills. This research focuses on the development of a minor in leadership development, which could prove invaluable to future career success.

Abstract

Incorporating Emotional Intelligence into Undergraduate Classrooms

A clear objective of post-secondary education is to develop professionals who are successful leaders in their careers. An academic minor in personal development and leadership skills could contribute greatly to the success of university graduates when they reach the workplace. Findings in the areas of emotional intelligence (EI) in coordination with leadership development could be one way to incorporate critical life skills into the current college curriculum. EI is directly linked with outstanding leadership, and Daniel Goleman's *Primal Leadership* gives a comprehensive model for professional leadership skills. A minor in leadership skills focusing on EI and *Primal Leadership* could prove invaluable to future career success.

Drs. Peter Salovey and John D. Mayer developed a formal theory of EI in 1990, followed shortly after by Goleman's popular books on the subject. According to the scientists, "emotional intelligence was a basic, overlooked intelligence" (Mayer, 2001, p. 7) and belongs to a team of interrelated intelligences in psychology, denoting "the capacity to understand, and use emotional information" (Mayer, 2001, p. 8). The most recent definition of EI by Mayer and Salovey expounds and clarifies this idea, and is referred to as the Mayer-Salovey four-branch model:

Emotional intelligence refers to an ability to recognize the meanings of emotions and their relationships, and to reason and

problem-solve on the basis of them. Emotional intelligence is involved in the capacity to perceive emotions, assimilate emotion-related feelings, understand the information of those emotions, and manage them (Mayer, 2001, p. 9).

Based on the research of Mayer and Salovey, Goleman's book *Emotional Intelligence*, presents EI to the public in layman's terms. Goleman's definition is expanded into five areas: "knowing ones emotions... managing emotions ... motivating oneself ... recognizing emotions in others ... [and] handling relationships" (Mayer, 2001, p. 9). In Goleman's definition, EI as an interrelated intelligence is de-emphasized and combined with other skills and characteristics. Goleman's model can be seen as not only a guide for understanding what EI is, but also a resource for understanding what other characteristics of one's personality may be important in changing one's destructive emotional habits.

In recent years, EI is being incorporated into the workplace setting. There are clear benefits to having emotionally intelligent employees, and many companies are hiring consulting firms which specialize in EI training. It can be concluded that educators should teach this same set of skills and abilities to undergraduate students entering the workplace. Bringing EI into the office promotes effectiveness in the workplace. For example, the ability to identify emotion in others and oneself gives employees the skill to understand critical emotional information in their interactions with colleagues. In relation to leadership skills in the workplace, being able to understand emotions gives leaders the ability to understand what might motivate individuals or teams, creating a better plan for how to work with them (Caruso & Wolfe, 2001, p.154).

After his popular book *Emotional Intelligence*, Goleman and others wrote *Primal Leadership*, a guide to development of emotionally intelligent leadership skills. According to Goleman et al., "the fundamental task of leaders ... is to prime good feelings in those they lead" (2002, p.ix). The four core dimensions of EI presented in *Primal Leadership* are self-awareness, self-management, social awareness and relationship management; their eighteen accompanying competencies are vehicles to primal leadership (See Figure 1).

Figure 1: Primal Leadership Emotional Intelligence Leadership Competencies

Self-Awareness	Self-Management	Social Awareness	Relationship Management
<ul style="list-style-type: none"> • Emotional self-awareness • Accurate self-assessment • Self-confidence 	<ul style="list-style-type: none"> • Self-control • Transparency • Adaptability • Achievement • Initiative • Optimism 	<ul style="list-style-type: none"> • Empathy • Organizational awareness • Service 	<ul style="list-style-type: none"> • Inspiration • Influence • Developing others • Change catalyst • Conflict management • Teamwork & collaboration

A minor in leadership development will give undergraduate students the opportunity to learn leadership skills through the study and personal development of emotional intelligence, in addition to real-world experiences built around *Primal Leadership* competencies. This program is designed as a minor to develop a skill set rather than concentration in one specific subject area. This skill set will consist of formal teachings and experiences which develop the student's leadership skills at an undergraduate level.

Although EI skills can be taught, it is ultimately up to the student to become more emotionally intelligent—they must develop the skills themselves. Each student's success and progress in the leadership development program will depend completely on the amount of dedication they put into it. It is the university's responsibility to assure the minor operates in such a manner that students are fully given the opportunities to develop their emotional intelligence and the *Primal Leadership* competencies. Students must be presented with a way to apply the concepts presented in their leadership courses. For this reason, required courses will be a combination of **study** courses and **experiential** courses. This idea is supported by Caruso and Wolfe in their essay "Emotional Intelligence in the Workplace": "teaching EI skills needs a knowledge-based component and an experiential component" (2001, p. 154).

Faculty appropriate for teaching courses in a minor such as this would likely possess most of the following qualities: a) basic knowledge of psychology, b) obvious leadership skills demonstrated in his/her own career, c) open to new ideas and thinks outside of the traditional



structure of education, d) basic knowledge of EI. Assuming faculty members have these qualities, they could come from any discipline.

The leadership development minor would consist of eight courses taken in a two year sequence. It would be recommended to students that they begin courses in their junior year; at this point in their personal development and academic careers, students are likely to be more self-aware and dedicated to the academic experience. A set number of students will enter the minor program each year as a cohort, taking the same courses at the same time. Fifteen to twenty students would be accepted into the program each year. Two courses would be taken simultaneously during each semester for two years. One course would be a study course while the other is an experiential course. The first year of the program will focus on EI development, while the second year will focus on leadership development (See Figure 2).

In the study course at the beginning of each semester, students will be given an EI test. Students will be given a performance test rather than a self-report questionnaire, preferably the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT V.2.0) or the Multifactor Emotional Intelligence Scale (MEIS). This begins the self-awareness process of becoming more emotionally intelligent; students are given the opportunity to evaluate themselves and self-correct destructive behavior. In addition, this gives the professor the opportunity to use the results to fine tune the course, “focusing on areas of weakness while providing ways for participants to use their strengths” (Caruso & Wolfe, 2001, 154). Students would also create a goal worksheet outlining their personal goals for the semester. Students will self-evaluate midterm as well as at the end of the semester to outline if goals are being met or if further concentration is required. In these courses, learning is self-directed and self-motivated; students will have the freedom to meet personalized goals through course activities. It is important to the process of this program that student’s goals are always unique to their personalities, skills, abilities and careers. This is just one way the minor supports active rather than passive learning. If students are setting their own goals and objectives, they are more likely to meet them.

The study course will not be a lecture course; it is important that class time focuses on discussion of

the course material, rather than lecturing on subject matter that can be easily read and understood during independent study time. There will be readings, class discussions, homework for personal development and accountability, and papers for reflection. Readings will vary, but will include materials from both scientific research journals and the lay press. For example, the first year of the program is focused on EI development, so students will study materials that enhance their EI knowledge and skills base. The reading list may include such books as *Emotional Intelligence in Everyday Life: A Scientific Inquiry* by Ciarrochi, Forgas and Mayer; *Emotional Intelligence: Why it Can Matter More Than IQ*, by Daniel Goleman; and *Leading With Soul: An Uncommon Journey of Spirit* by Bolman and Deal. The second year of the minor in leadership development focuses on leadership skills and the reading list may include such books as *Primal Leadership* by Goleman, Boyatzis and McKee; *Leadership is an Art* by Max DePree; and *The Five Dysfunctions of a Team* by Patrick Lencioni. These and other readings will be the focus of class discussion; students will discuss the readings and their pertinence to the course and personal development. Students will have the opportunity to share successes and failures in their development, providing team support and the opportunity to gain knowledge from others.

Homework in the study course would be based on EI in general as well as class reading assignments. Homework will consist of specific questions focused on leadership and self-development which can only be answered after reading the material. This provides the structure students are used to, in addition to assisting with accountability. Homework assignments will provide an objective structure for grading the students.

Each student will keep a personal development journal to be turned in every two weeks. There will be a series of reflection exercises in the journal based on the course work. These will be open-ended questions that provide a starting point for students to reflect on their progress and development. For example, one reflection exercise may state, “Based on your reading of the article ‘Affective Intelligence’ state a situation when your mood played into how you perceived a situation. Write an essay on how a different mood might have been better or worse in the situation.” This is an example of how the course will provide students with the opportunity to reflect further on their readings. This encourages growth in

Figure 2

	Title	Objective	Activities	Evaluation
Year 1 Fall Semester Focus: Emotional Intelligence	“Study Course in Emotional Intelligence: Part 1”	Student will gain knowledge base of EI, setting the ground-work for leadership development	<ul style="list-style-type: none"> • Readings • Homework Assignments • Class Discussion • Journal • 2 Papers • Individual Project 	<ul style="list-style-type: none"> • Homework (10%) • Class Participation (10%) • Journal (25%) • Paper 1 (15%) • Paper 2 (15%) • Individual Project (25%)
	“Experiential Course in Team Development: Part 1”	Students will have opportunities to use EI in team setting with focus on campus outreach	<ul style="list-style-type: none"> • Team Project (campus outreach) • Individual Journal • Team Meetings • Project Presentation • Project Report 	<ul style="list-style-type: none"> • Meeting Evaluations (25%) • Individual Journal (25%) • Peer Evaluation (10%) • Team Project Reports (10%) • Final Project Presentation & Report (30%)
Year 1 Spring Semester Focus: Emotional Intelligence	“Study Course in Emotional Intelligence: Part 2”	Students will continue with focused study on EI development, with emphasis on personal skills & goal attainment	<ul style="list-style-type: none"> • Readings • Homework Assignments • Class Discussion • Journal • 2 Papers • Individual Project 	<ul style="list-style-type: none"> • Homework (10%) • Class Participation (10%) • Journal (25%) • Paper 1 (15%) • Paper 2 (15%) • Individual Project (25%)
	“Experiential Course Team Development: Part 2”	Continued and more complex opportunities to use in EI in team setting, with focus on community project	<ul style="list-style-type: none"> • Team Project (community service) • Individual Journal • Team Meetings • Project Presentation • Project Report 	<ul style="list-style-type: none"> • Meeting Evaluations (25%) • Individual Journal (25%) • Peer Evaluation (10%) • Team Project Reports (10%) • Final Project Presentation & Report (30%)
Year 2 Fall Semester Focus: Leadership Leadership	“Study Course in Leadership Development: Part 1”	Students will gain knowledge base of <i>Primal Leadership</i> and how it relates to EI, in addition to focusing on <i>Primal Leadership</i> competencies	<ul style="list-style-type: none"> • Readings • Homework Assignments • Class Discussion • Journal • 2 Papers • Individual Project 	<ul style="list-style-type: none"> • Homework (10%) • Class Participation (10%) • Journal (25%) • Paper 1 (15%) • Paper 2 (15%) • Individual Project (25%)
	“Experiential Course in Leadership Development: Part 1”	Opportunity to use <i>Primal Leadership</i> skills in team setting, project focus on creating change on campus	<ul style="list-style-type: none"> • Team Project (Campus Change) • Individual Journal • Team Meetings • Project Presentation • Project Report 	<ul style="list-style-type: none"> • Meeting Evaluations (25%) • Individual Journal (25%) • Peer Evaluation (10%) • Team Project Reports (10%) • Final Project Presentation & Report (30%)
Year 2 Spring Semester Focus: Leadership Skills	“Study Course in Leadership Development: Part 2”	Continued focused study on <i>Primal Leadership</i> development, strict focus on <i>Primal Leadership</i> competencies	<ul style="list-style-type: none"> • Readings • Homework Assignments • Class Discussion • Journal • 2 Papers • Individual Project 	<ul style="list-style-type: none"> • Homework (10%) • Class Participation (10%) • Journal (25%) • Paper 1 (15%) • Paper 2 (15%) • Individual Project (25%)
	“Experiential Course in Leadership Development: Part 2”	Opportunity to use <i>Primal Leadership</i> skills in team setting, focusing on a project which changes student’s community in some way	<ul style="list-style-type: none"> • Team Project (Community Change) • Individual Journal • Team Meetings • Project Presentation • Project Report 	<ul style="list-style-type: none"> • Meeting Evaluations (25%) • Individual Journal (25%) • Peer Evaluation (10%) • Team Project Reports (10%) • Final Project Presentation & Report (30%)



EI because it presents the opportunity to understand one's own emotions, while providing the chance to connect reading assignments to real-world situations.

There will be two papers due as a midterm and final. These papers should illustrate leadership skills and specific information the student has learned in the course. The subject matter of the papers will focus on the individual project, explaining the details of their project in addition to scholarly research found to support their work. It is an opportunity to reflect on how the course teachings relate to their individual project. This project is completely of the student's design and must show leadership and personal development skills. This is an opportunity for students to shine individually and incorporate their major or career into the project. For example, a student majoring in Education might design a project focusing on a new program to enhance communication between schools and parents. During her project she may consult principals and teachers in the area and conduct surveys concerning the current school/parent relationship. In the paper, she would have the opportunity to reflect on how EI and leadership skills played a part in her project. Classmates and the professor(s) would be available for consultation and support.

The second project to be completed each semester is a team project. This project will be the main concentration of the experience course taken each semester. These projects will become increasingly more complex throughout the two year program. For example, in their first semester, students may start by hosting an after school program for neighborhood kids; whereas, in the last semester of their senior year, students might propose a new law for their state. The professor will assign a general topic for team projects, while it is the student's responsibility to narrow down the idea. For example, the professor might state that the project focus is on improving the environment, while students would specify a community-driven promotion of hydrogen-fueled cars.


Each team project would have specific requirements and guidelines, serving as the grading structure for the experience course. For example, each team must take notes during each meeting. Each person in the team must be involved and participation points will be a portion of the student's grade. This percentage of each student's grade will be determined by their

peers. Individual responsibilities will be determined by the team and work will be recorded so each person is held accountable for their work. Because an academic minor will be awarded based on these courses, each student's progress will be carefully recorded and judged individually. In addition, students must keep a project journal, to be turned in once per month. This is simply the individual reflections of each team member, based on the team's performance. This is an opportunity for individuals to reflect on the team project one-on-one with the professor.

In the first year of the program, team projects should focus on making a difference on campus and in the local community. These projects are focused on "lending a helping hand," so to speak. Projects will be equivalent to community service, but are completely developed and supervised by the students. This will give students the opportunity to learn how to be involved in a team working towards a shared goal, and the experience of a self-directed project. In addition, students are working for a purpose, which will assist with the personal reflection process integral to the first year of the program. It will teach students to evaluate their own lives and actions in ways they might not have before. It will also teach students how to act as a team without the pressure of creating change. The second year of the program will teach students the crux of leadership—creating change. The focus will be on creating change within the support of a team setting. In this way, students will develop life skills needed in team situations, while working towards a shared goal.

There are a few reasons this program might be considered as a minor, rather than a single course. A semester long course is too short to accomplish the goals of emotional intelligence/leadership development. Leadership cannot truly be developed in one semester. Skills must be learned and there must be time for personal development. In addition, experience is one of the best learning tools. A series of courses would provide experiential opportunities to learn leadership hands-on. A minor is stated on the student's transcript, giving them an obvious record of their achievement; this may be an important incentive for students with an already limited course schedule. This minor would be open to all students who want to gain leadership skills in an intense experience driven series of courses.

By the end of these two years, students will have developed leadership, personal development, and life



skills. They will have completed two service projects on campus and two in the community, as well as four individual projects related to their personal interests and academic/career goals. For two full years students will study leadership texts and have the opportunity to use the information they have learned. Students will learn (through both study and practice) life skills, leadership skills, how to relate to others, how to create change, following ideas through from conception to completion, self motivation and many more skills useful in the workplace.

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The Differences and Similarities between First and Second Generation Drugs for Epilepsy

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Abstract

It has been found that those with epilepsy have a consistent lower bone mineral density (BMD) than an average person. There are many factors that could contribute to reduced bone density; these include lack of exercise, poor diet, and genetics. With epileptic patients, often times, anti-epileptic drugs (AEDs) are prescribed. AEDs have a variety of different structures and components. The drugs include enzyme inducing and non-enzyme inducing drugs as well as first and second generation drugs. Because of the different structures and components of the drugs, there has not been conclusive evidence as to how and where the drugs affect bone density in the human body. The study of the drugs' interaction with BMD includes taking a patient's ongoing chart and compiling variables that could influence bone density. The study will take variables and use correlation analysis to see if there is a link between the variables. If there is a correlation then, this study will influence future prescriptions of AEDs in which additional supplements for bone buildings will also be provided. Further, Medicaid in the year of 2005 no longer covers a Dual Energy X-ray Absorptiometry (DEXA) bone scan which is the instrument used to determine bone density. This is quite concerning, as determining bone density for patients with epilepsy is critical for the prevention of greater risk of bone loss.

The Differences and Similarities between First and Second Generation Drugs for Epilepsy.

Imagine suddenly you lose control of the one thing you always felt you would be able to control, your body. Imagine you lose control of your body at any time, in any place. Imagine you can't do anything about it. This is the daily trial of someone who suffers from epilepsy. The endeavors epileptics face just to function and have a normal day are difficult and highly uncontrollable.

Drugs are used to control convulsions, or seizures that epileptics suffer from which may also have adverse effects. The AEDs have short term relieving effects on seizures; however, they also have negative long term effects, including the osteoporosis, which is a bone disease causing brittle and decrepit bones (Andress, 2002). There are a variety of preventative measures to avoid the osteoporosis. According

to the National Osteoporosis Foundation (2005), preventative measures include taking vitamin and mineral supplements, having a balanced diet, and exercising regularly. Only 28% of neurologists screen for bone disease, even though the negative repercussions that arise from the AEDs they prescribe are well known (Valmadrid, 2001). Future illumination of the problems produced by AEDs will hopefully redefine the future system of prescribing drugs to prevent further complications for epileptic patients.

Purpose of Study

First generation drugs were created from 1912 to 1980. Multiple studies were conducted on the first generation drugs over the expanse of time. The FDA started approving second generation drugs in 1993 (Sirven, 1997). The long term effects of second generation drugs are unknown (Beerhorst, 2005). This study focuses and analyzes the following hypothesis: Do second generation drugs have the same effect on bones as first generation drugs? The foundation of the research was to review the data and explore the possible negative bone results with second generation drug use. Data involving negative bone growth is critical because the information can be used for early preventative measures to help aid bone construction and to lessen the possibility of bone disease. Bone disease is correlated to epilepsy and the drugs used. First generation drugs have an impact on bone, but it is assumed second generation drugs also have an impact on bones. This study can have far reaching influences on the practice of doctors and patient knowledge regarding the issues of AEDs and bone health.

Methods

The methodology of the study involved a retrospective chart review. A criterion was established as to which charts would be analyzed. The patients were required to be between the ages of 12 to 89, be on AEDs for at least two years, and have been given a dual energy x-ray absorptiometry (DEXA) performed with results of bone mass density. All patients were from the Via Christi Comprehensive Medical Center and under Dr. Kore Liow's instruction.

The retrospective chart review was an in-depth study to gauge the effects of the drugs on bone. The information could not be skewed in any manner

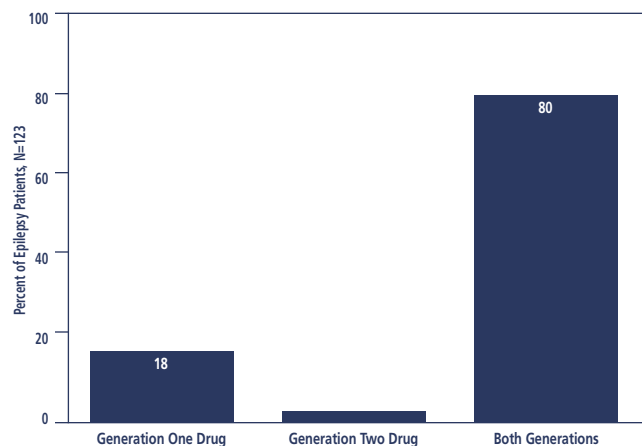
because the information was clearly in the charts. Also the history, sometimes spanning back 40 years in the patients chart, could be looked at for analysis that could best be correlated to the effects on bones.

After reviewing the charts, data was collected from the demographics, including the DEXA results, and the drugs historically used by patients. All of the variables were entered into SPSS and used for statistical analysis. After conducting a few trials, the results were very surprising.

Results

After statistical analysis, certain variables were taken into account to get a better idea as to the actual effect of the drugs on the bones. The first graph demonstrates the percentage of epileptic patients whose charts were reviewed and the generation of drugs they were using.

Percent of Epileptic Patients Analyzed



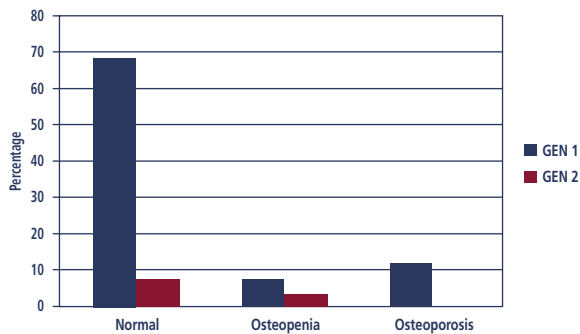
As can be seen, the number of people on monotherapies, or only on generation one or generation two drugs, is very low. The patients on both of the drugs are exceptionally higher. These numbers then can lead to flawed statistics. For example if a patient was on both of the generation drugs, the effects on bone density may increase from the use of both drugs, and not just from one of the generation drugs.

The second graph is taking the results of the generation independently, the two monotherapies, and applying it to the status of the bone health.

As the graph demonstrates, generation one drugs have much higher effects on BMD for the patients than do second generation drugs. The results are



Generation One and Two Bone Mineral Density



Status of Bone Mineral Density

highly surprising and the hypothesis was proven null; in fact, second generation drugs did influence bone density but not to the extent of first generation drugs.

Though the results in this graph are pointing in the direction of no influence on bone density by second generation drugs, the limitations of the study and data need to be considered. First, the patients were not chosen at random. There was no randomized population so the pool of patients whose charts were reviewed may not be significant to actual epileptic patients. Also, the second generation drugs have not been in existence or in use nearly as long as the first generation drugs. For that reason, the effects that the use of second generation drugs could have on the bones is more difficult to determine because they have not been used as long as the first generation drugs. Because of these known factors, the data and results could have easily been skewed.

Conclusion

Although the results indicate second generation drugs do not influence bone health as much as first generation drugs, preventative measures and

education about potential health problems for epileptics need to be implemented. For epileptics, it is better to be safe than to be sorry. The future results of new developments in the prescription drug world for epileptics are one of uncertainty; however, what can be certain is that the patients and doctors must do what they can to divert preventable health complications. As new discoveries of BMD and AEDs arise, the neurology and epileptic community should be receptive to the dangers and risks, along with the potential advantages of new research. The hope for the future is to have a cure for epilepsy. With further research, one day this hope may be realized.

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Pre-service Elementary Teachers' Conceptual Understanding of van Hiele's levels of Geometric Reasoning

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Summary

ierre van Hiele and Dina van Hiele-Geldof designed a theory of geometric thought called van Hiele levels that is sequential and hierarchical. According to this theory, learners move from a level of recognition (level 0 – being able to only visually recognize shapes) to being able to carry through formal geometric proofs (level 4) (Van Hiele, 1986). Current research supports that most pre-service teachers reason geometrically up to the level of visual analysis (level 1), which is the ability to recognize shapes as a collection of geometric properties, but are not able to reason abstractly and perceive relationships between these figures (high school deductive geometry is at level 3). This is because they have not been provided an adequate and supportive environment to learn to reason geometrically and thus are unable to adequately prepare their students to develop solid geometric skills. This results in an endless and vicious cycle of geometric ignorance.

Using naturalistic inquiry, we studied pre-service elementary teachers' ability to understand levels of geometric thought and their ability to increase the quality/level of their own geometric reasoning within a social-constructivist environment. *Naturalistic Inquiry* is a research technique that requires observation of the subjects in their natural environment where they are monitored for change and a control group is not needed. In the context of this paper, a *social-constructivist environment* is one in which the participants are allowed to build their own learning forum where they are now using investigative tools.

Twenty-two pre-service elementary teachers who enrolled in a mathematics investigation course were given a pre/post test to measure their progress in the knowledge and understanding of geometry. The course models an investigative problem-based approach within a *dynamic geometric environment (DGEs)*, and other tools known to encourage higher levels of geometric thinking. A Dynamic Geometric Environment is any software that allows the user to create, manipulate, and animate geometrical objects. Keith Jones (2001) suggests the DGE mediates the learning of mathematical explanations of geometry and influences student interpretations of geometric construction and manipulation. Also,



dynamic geometric environments provide access to exploration of geometrical theorems. With access to the dynamic software, a classroom environment encourages conjecturing, a focus on mathematical explanation, carefully designed tasks, and sensitive teacher input, students can formulate mathematical explanations within the DGE (Jones, 2000). In such an environment, conducive to geometric thinking, students can broaden their understanding within the level at which they are and maybe even move to the higher level of geometric reasoning. In addition to providing a researched based learning environment, participants studied van Hiele levels, created geometric problem sets with solutions using various forms of technology, gave presentations, and discussed their own thinking (metacognition) with their peers.

Results from the pre-post assessments indicated that pre-service teachers taught using social-constructivist methods, broadened their knowledge of geometry (collectively by 13% gains and some individually by 40%) and felt better prepared to teach geometry (measured by survey). Forty-one percent of the pre-service teachers solved all problems related to the van Hiele levels 0-2, showing some progress to

level 2. This implies they will be better equipped to reason geometrically and to teach their students to do the same.

Principles and Standards for School Mathematics (NCTM, 2000) suggests strong emphasis on developing geometric reasoning through all K-12 grade levels. Many of today's teachers are not well prepared to facilitate such learning. This study shows that in an appropriate dynamic environment teachers can improve their knowledge and understanding of geometry.

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A Comparison Between Traditional Wireless Ad Hoc Network Routing Protocols in a Densed Network

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A

Summary

As the ad hoc network applications begin to grow, many researchers have conducted various simulations trying to find the best solution to provide an efficient mechanism to fairly serve all users while still providing high throughput. Most of these comparison simulations, however, were done assuming there is a low network density and the individual data rate is relatively small. This can create inaccurate results as the fact that our wireless networks today are becoming denser and our traffic is getting heavier. The main purpose of this paper is to compare the performance of different ad hoc network routing protocols based on the convergence time and throughput in an extremely dense network. Simulations were done using a total of 250 nodes with a distinguished number of sources and a number of packets delivered per second.

According to [1], an ad hoc network is “a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration.” Each node in a wireless ad hoc network functions as both a host and a router. The network topology is in general dynamic, because the connectivity among the nodes may vary with time due to node mobility, node departures, and new node arrivals. Hence, there is a need for efficient routing protocols to allow the nodes to communicate.

To allow communication and information sharing, ad hoc nodes or devices should be able to detect the presence of other such devices. In addition, the ability to identify types of services and corresponding attributes are also taken into consideration. Since nodes change dynamically, routing information also changes to reflect the changes in link connectivity [3].

The Ns-2 simulator was used to successfully simulate our assumption with CBR (Continuous Bit Rate). The source-destination pairs are spread using first node – last node pair; that is, the source starts from node 0 while the destination starts out from node 249. The number of source-destination pairs and the packet sending rate in each pair is varied to change the offered load in the network.

The mobility model uses the *random waypoint* model [2] in a rectangular field (1500 m x 300 m). The data packet size is fixed at 1000 bytes with 1 Megabit capacity. Each node starts its journey from



a random location to a random destination. Three different packet rates are used: 1 packet/sec, 16 packets/sec and 192 packets/sec. All sources start sending out packets in a uniform range between 0 and 100 seconds. Simulations are run for 200 simulated seconds for 10 sources, and 400 simulated seconds for 50 sources and 125 sources. For simplification, assumptions of no mobility and identical traffic scenarios were made across routing protocols.

For simulations with 10 sources and 192 packets/sec, Dynamic Source Routing (DSR) out performs the other two networks protocols. With a relatively small number of delays, the maximum time it took for a node to converge using DSR is under 2 seconds whereas for Destination-Sequenced Distance Vector it is approximately 5 seconds. For simulations with 50 sources and 1 packet/sec, all routing protocols delivered packets within the first few seconds except for Ad Hoc On-Demand Distance Vector at node 35. It appears the node has trouble receiving the packet and it has to resend the packet a few times before it reaches the intended destination.

The higher number of sources used, the more packets dropped along the way. In fact, some nodes never get converged with 50 and 125 sources. This is due to a high level of network congestion and

multiple access interferences in certain regions of the ad hoc network. Neither protocol has any mechanism for load balancing, i.e., for choosing routes in such a way that the data traffic can be evenly distributed throughout the network. All protocols perform very well with a small number of sources. DSR converges in a lesser amount of time compared to DSDV and AODV in a small network. On the other hand, AODV delivers better throughput in a larger network. For 125 sources simulations, packets are dropped tremendously. An extension of this work is recommended for future simulations with C-MAC protocol to achieve better performance.

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The Role of Adolescent Crime Fantasies on Property Crime Behaviors

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T

Summary

his research examined the relationship between adolescent fantasies about committing property crime and actually committing the crime. The study addressed the following question: When adolescents think and fantasize about property crime, does their tendency to commit property crimes increase? The Federal Bureau of Investigation's Uniform Crime Report (UCR) of 2001 attributed 105.1 property crimes per 100,000 inhabitants to ages 12 and under, while ages 13-14 account for 1511.5 property crimes per 100,000 inhabitants. Though the previous numbers are fairly small, it should be noted that these are simply reported crimes. It is important to study property crime and property crime fantasies because it gives us an idea of what types of crimes we may attribute mainly to adolescents and what factors influence why such crimes are committed. The operational definition of property crime for this study is defined as theft, vandalism, and burglary. Fantasy as defined by Burgess, Hartman, Ressler, Douglass and McCormack (1997) is "an elaborate thought with great preoccupation, anchored in emotion, and having origins in daydream" (p. 256). It is imperative to distinguish that this is a pilot study.

Most property crimes tend to be committed by adolescents. Some suggest this is due to lack of responsibilities and increased peer pressure during adolescence. Cox, Cox and Moschis (1993), discovered that crimes such as theft (which includes shoplifting) were more likely to occur during adolescence when peer pressure is at its greatest (p. 234-247). Other theories suggest adolescents are considered lower class and may not have the skills or the opportunities to find adequate employment. Since they may be too young to work, adolescents may have more idle time than other age groups. Adolescent status in society and peer pressure are some of the variables that can influence adolescents when faced with the opportunity to commit a property crime.

A search of the literature revealed no research in the area of adolescent property crime fantasies; however, research was conducted to examine crime fantasies in regard to sexual crimes. In their study titled, "The Role of Criminal Fantasy in Opportunist and Predatory Sex Offending" Deu and Edelman (1997) discovered that predatory



sex offenders were more likely to report organized criminal fantasies before committing the offense while opportunist sex offenders were less likely to report organized criminal fantasies. Predatory sex offenders are those who planned to commit their crime in detail before putting the plan into action, while opportunist sex offenders are those who take the opportunity to commit crime without having planned any specific details with regard to committing the crime.


The current study was conducted in an urban city in the Midwest and consisted of 31 participants (19 males and 12 females) who were 7th and 8th graders and were either students in a small private Catholic School or participants of the summer program at a Boy's and Girl's Club. It is important to note that this study should be treated as a pilot study due to the small sample size. A survey consisting of 19 questions was administered to participants by a faculty member of the respective organizations. The parents of the participants were asked to sign a consent form allowing their child to participate. The participants were then asked to sign an assessment form before completing the survey stating they were aware that parent permission was obtained and they were willing to participate. After the participants at their respective organizations completed the survey, a debriefing occurred in which the participants were free to express any concerns or thoughts generated by the survey. In answering the research question, we attempted to discover dominant patterns in adolescent property crime fantasies and property crime behaviors.

Of the participants, 58.1% reported they "rarely think about" property crime and 38.7% reported thinking about property crime "sometimes." Although reporting moderate to low thoughts of property crime, 16.1% reported committing theft and 38.7% reported being caught committing theft. This means that although more than half of the participants reported they rarely think about property crime, a total of about 54% admitted they had committed the crime of theft. This indicated that either the participants did not fantasize about committing the crime or that they were not aware of thinking about the crime prior to committing it. For vandalism, 25.8% reported committing the crime, however, 22.6% reported being caught and only 3.2% reported committing the crime more than once. Although

not directly investigated in this study, peer pressure is important to recognize because of its prevalence during adolescence and its influence on adolescent thoughts and behaviors. The majority of respondents described peer pressure from friends as occasional or brief with 11 of the 18 who reported "rarely" thinking about property crime falling into this category. The dominant pattern of this study indicates individuals who perceive that they have minimal levels of peer pressure (i.e. socialized adolescents) rarely report deviant fantasies.

There were several limitations to the current study. First, the sample size was small and may have had an effect on a non-statistically significant outcome of the results. Second, because faculty members from the respective organizations administered the survey, the survey itself was subject to experimental error. Third, as with any survey or questionnaire, the experiment was subject to the reliability of self-report. Under-reporting may have been an issue due to the controversial nature of this study and fear of discovery or punishment for the crimes reported.

In conclusion, this research is important because understanding some of the factors that influence adolescent crime is crucial. Due to the status of adolescents in this country who may have too much idle time and be too young to work, adolescent property crime is an important issue. Although this study did not find significant results, the subject and its implications on adolescent crime may be considered significant. If we know fantasies often precede criminal activity in adults, then it is possible we can learn what triggers those fantasies in adolescents and determine how we can study them. For this study, most respondents reported they "rarely" thought about property crime, and yet they indicated they had, in fact, committed a property crime. This suggests fantasy either plays a minimal part in adolescent property crime or adolescents are not aware of the impact of fantasy on criminal behaviors. If we are cognizant of the duration and frequency of criminal fantasies within a person, we can possibly predict the likelihood of criminal activity. Further research could focus on criminal fantasies and financial status, criminal fantasies and gender and/or race differences as well as an in-depth study of the other factors, such as peer pressure and its influence on adolescent criminal behaviors.



Knowledge and Awareness of Attention Deficit Disorder Among Future Teachers

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Summary

Attention Deficit Hyperactivity Disorder (ADHD) is a neurological condition characterized by three patterns of behavior: inattention, hyperactivity, and impulsivity (Alban-Metcalf, 2001). In addition to the three types of behavior, there are three subtypes of ADHD recognized by professionals: (a) Attention-Deficit/Hyperactivity Disorder, Predominately Hyperactive Type; (b) Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type; and (c) Attention-Deficit/Hyperactivity Disorder, Predominantly Combined Type. Some children are identified as exhibiting behaviors of the predominantly hyperactive-impulsive type and may not show significant signs of inattention (Strock, 2003). Others are predominantly the inattentive type and may not demonstrate significant hyperactive-impulsive behaviors, while some children are the combined type and may display both inattentive and hyperactive-impulsive behavioral characteristics (Strock). In order for children to receive the diagnosis of ADHD, these behavioral characteristics must have been present before seven years of age and at a more severe rate than what is typical of children of a similar age. Because many children exhibit characteristics of ADHD, but at a lower level, and also because the behaviors may be caused by another disorder, it is critical that children receive a comprehensive examination and appropriate diagnosis by a well-qualified health care professional.

According to Strock (2003), the National Institute of Mental Health estimates between three and five percent of children have ADHD, which equals approximately 2 million children in the United States. Strock reports that in a classroom of 25 to 30 children, most likely at least one student will have ADHD. Due to the prevalence of ADHD and its significant impact on students, families, and classrooms, teachers have a great responsibility to be aware of the disorder.

Considering the significance of the issues surrounding ADHD and the pertinence to the education of children, this project explores the awareness future teachers have about ADHD. The perceptions of future elementary school teachers was assessed regarding their (a) knowledge of the characteristics of ADHD and (b) readiness to address the needs of the students identified with ADHD.



For purposes of the study, 37 future teachers completed a survey that consisted of 12 items derived from previous research (Jerome, 1999). The 12 items focused on diagnostic symptoms of ADHD as well as myths associated with ADHD. The 37 participants, consisting of thirty-five females and two males, were selected from a university located in the state of Kansas. Each teacher was required to be within one semester of completing his or her Bachelor degree and seeking employment as an elementary school teacher. The teachers were required to sign consent forms, which informed them of the purpose of the study, assured them of confidentiality, and provided them with the option to withdraw. The survey was based on questions regarding causes, characteristics, learning styles of children with ADHD, adequacy of their college preparation, and definitions of ADHD.

The results of this pilot study suggested these future teachers were aware of most of the characteristics associated with ADHD and were able to decipher most myths from facts regarding ADHD. Teachers reported they were aware of many of the characteristics of ADHD including behaviors such as skipping from one uncompleted activity to another or having difficulty listening when spoken to directly. The majority of the teachers (81%) answered correctly that ADHD is more prevalent in boys than in girls. The teachers' answers were divided equally in terms of their knowledge of the relationship between cigarettes and alcohol use during pregnancy and the child's chances of having ADHD, while 62% recognized the connection of ADHD and heredity. Encouragingly, the sampled teachers indicated they understood that children with ADHD do not exhibit physical characteristics such as appearance and were aware that children with ADHD have a biological vulnerability toward inattention and self control.

Further, the teachers reported they realized that poor parenting may or may not be related to the student's ADHD behaviors. Overall, the participants of this pilot study reported they were knowledgeable of ADHD and recognized the signs associated with it.

The results were mixed in terms of teacher responses regarding their perceptions as to whether their preparation to work with students with ADHD was adequate. For example, fourteen teachers reported they were neutral, neither agreeing nor disagreeing that they were prepared. Further, four teachers indicated they were definitely prepared; eleven indicated they were prepared; and eight did not feel prepared at all.

This study was limited due to the small sample size. Additionally, an extended survey was needed to garner further information related to teachers' awareness of the three levels of behaviors and three subtypes of ADHD. With a growing rate of students with ADHD in the classroom, further research is critical to assess teachers' knowledge of ADHD characteristics and their readiness to provide students with essential accommodations in the classroom.

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Juvenile Prevention and Intervention Programs in Sedgwick County

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Summary

With society's increasing demand for crime prevention, the need for prevention and intervention programs has never been greater for today's youth. As our communities struggle to deal with youth and violence, the research indicates the juvenile homicide rate has doubled and arrests for serious violent crimes has increased 50 percent between 1984 and 1994 (McGill, 1998). The search for some effective ways to prevent this carnage and self destructiveness has become a top priority. To date, most of the resources committed to the prevention and control of youth violence, at both the national and local levels, have been invested in untested programs based on questionable assumptions and delivered with little consistency or quality control. This review of literature focuses on comparing juvenile prevention and intervention programs.

Knowledge of prevention and intervention programs is important because, according to the *Juvenile Justice FYI* website, "The most effective way to prevent juvenile delinquency has indisputably been to assist children and their families." Prevention is the first step to helping youth avoid getting in trouble at school, home and with the law. Prevention involves taking steps to "prevent" the juvenile from getting in trouble in the first place. Intervention is as important as prevention. Intervention programs "intervene," or step in, once the juvenile has had problems such as not attending school or committing minor misdemeanors. Intervention comes into play once the juvenile delinquent has been involved with the court system.

A number of the juvenile prevention and intervention programs have been established in the local community for many years, such as Community in Schools which has been in Sedgwick County for over twenty five years; however, these programs lacked community wide support. By 1998, the juvenile crime rate had increased dramatically and "Many school related incidences had occurred and caused major concern in Sedgwick County" (Craig-Moreland, 2004). In order to combat this influx in juvenile crime, in 1998, Kansas began to develop a plan to reduce juvenile delinquency and to support prevention programs by providing a million dollars in annual funding to the cause. In order to assess Kansas's current progress in the fight against juvenile delinquency, this research examines the potential success



of prevention and intervention programs currently serving in Sedgwick County.

Three intervention and three prevention programs that exist in our communities were the focus of this research. The programs were selected because they met the following criteria: they are well known to the general public, serve the male and female population, and are currently grant recipients. The prevention programs selected for examination include: Big Brothers and Big Sisters (BBBS) which gives youth a sense of belonging through adult mentorship; Community in Schools (CIS), a program helping young people within the school system who have low achievement scores and the Functional Family Therapy Program (A Violence Prevention Model), an organization providing service for juveniles who have supervision problems. The intervention programs examined for this research were: Community Truancy Immunization Project (CTIP) which provides youth with their first engagement with the juvenile justice system and Teen Intervention Program (TIP) which deals with juveniles who are first time offenders and have committed crimes such as shoplifting, fighting and other things considered to be minor misdemeanors and the Boys and Girls Club Targeted Outreach Program (TORP), an academic- based program, which serves youth who have been suspended or expelled from USD 259 (Craig-Moreland, 2004).

The Sedgwick County *Juvenile Justice Authority and Crime Prevention Funded Programs* evaluation book was utilized to compare success rates of the programs included. The data reviewed suggests the Sedgwick County's juvenile prevention and intervention

programs do have successful outcomes. All of the Sedgwick County juvenile prevention and intervention programs reviewed met at least one or more of their expected outcomes for the 2004 fiscal year. For example, Big Brothers and Big Sisters surpassed their goal of having "70% of the youth maintain or show improvement in their ability to avoid substance abuse" and The Boys and Girls Club Targeted Outreach Program exceeded their suspension-reduction goal and had "100% of their students not be suspended during their follow up period" (Craig-Moreland, 2004). Most of the programs still have goals they will need to meet, but the statistics indicate the programs are making progress. With some of the programs already demonstrating successful outcomes, and others being well on their way to meeting their expected goals that were not fulfilled for the 2004 year, the prevention and intervention programs appear to have a positive impact on the community. Thus, Sedgwick County provides an excellent example of how "Preventative and rehabilitative measures have been proven time and time again to significantly lower the likelihood of a youth offending (or reoffending)" (*Juvenile*).

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Social Alienation and the American Dream

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Summary

his literature review focuses on social alienation and the “American Dream.” Social alienation is a trend in our society in which people withdraw from one another, resulting in feelings of isolation and hopelessness. The American Heritage Dictionary defines the American Dream as “an American ideal of a ... successful life to which all may aspire.” Of particular interest regarding social alienation and the American Dream are changes in our society contributing to declining trust in others, which seems to have resulted in disillusionment with the American Dream. The current trends lean towards a temporary and flexible workforce, declining social capital, and growing disparities in income are issues of concern. In addition to reviewing the literature regarding these issues, a cumulative data file known as the General Social Survey (GSS) was also examined.

In 2003, Brian Starks reported the ability to reach the American Dream involves capitalizing on economic opportunity. Americans believed loyalty and hard work would pay off with security and stability (Starks 2003). However, many factors negatively influence these attitudes of Americans today. Today, the fastest growing sector of the American workforce is temporary and flexible employment (Sennett 1998). Sennett indicates the current trends toward a portable and mobile workforce and reduction in long-term employment diminishes our trust of and commitment to others. When workers are temporary, whether working two weeks, two months, or even two years in an organization, people are unable to establish meaningful friendships and associations in such a short length of time. Additionally, as temporary employees, workers may frequently need to relocate to find better jobs. Sennett reports this mobile workforce adversely affects friendships in this post-industrial era. Before the post-industrial era, friendships were formed within communities and developed over longer periods. In today’s society, friendships seem to be work-based rather than neighborhood based (Putnam 1995). The trend of short-term employment and a mobile workforce significantly reduces the ability to build lasting friendships through employment (Putnam). To illustrate this dilemma, Putnam uses the phrase “the Repotting Theory.” The Repotting Theory refers to the mobility in the labor force, which disrupts the root system of people. This disrupted root system affects the ability to maintain



long-term friendships, which increases the likelihood of social alienation. Temporary employment and a mobile workforce present barriers to creating social networks and lasting ties with others. These barriers serve to reduce social capital, “features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit” (Putnam 1995:65). Given the milieu of the current workforce, networking, building trust and cooperation in organizations becomes quite difficult.

Another significant area of concern in today’s society is the growing disparities in income. Sennett refers to today’s American society as “a two-tier society ... a few winners ... lots of folks being left behind” (1998:54). Considering the inequities this country is experiencing, the question arises, what is happening to the middle class? Sennett quoted Alan Greenspan, from a 1995 Wall Street Journal article, as saying the unequal income issues “could become a major threat to our society” (1998: 54). As the wealthy prosper, low-income and middle-class Americans struggle just to make ends meet. This struggle diminishes hopes of attaining the American Dream.

In order to better understand people’s attitudes and beliefs regarding these current issues, the GSS was reviewed. For purposes of this research, the following variables from the GSS were explored: 1) alienation, which included questions based on trust (can people be trusted), fairness (are people fair or do they take advantage of others), and helpfulness (are people helpful or just looking out for themselves); and 2) the American Dream, which included questions about economic uncertainty (unemployed in the last ten years), job certainty or fear of unemployment, and changes in financial situation.


In addition to the literature reviewed, the General Social Survey, compiled between the years of 1972-2000, provided the study with an assessment of individuals’ attitude and beliefs about American society. The data from the GSS revealed that over the last 30 years, trust has declined ten percent. Fairness ratings remained the same over time; however, 30 percent of the respondents indicated they believe that people take advantage of one another and 30 percent of the respondents also indicated they believed that people only look out for themselves. According to the GSS, one-third of the respondents had been unemployed in the last ten years. Between 60 and 70 percent of

the respondents reported they felt their job is secure, while 30 to 40 percent indicated they worry about job loss. These figures depict trends toward a significant lack of trust in others as well as feelings of uncertainty about the future. If the GSS figures are representative of the nation, it may suggest the hope of attaining the American Dream is rapidly fading.

With society becoming a collection of temporary and mobile workers whose social and economic capital is declining, trust in each other — and in the future — corrodes. Trust is integral to bonding with others and feeling a part of society. For some individuals, these concerning quandaries may turn what was supposed to be the American Dream into a surrealistic nightmare. Further study of the long-term effects of unstable working conditions, a mobile workforce, declines in social capital, and rising economic inequality must be conducted to provide greater insight in relation to these alarming trends. The bottom line is this: each and every one of us should be able to attain the American Dream. Each and every one of us should have hope for the future. The whole basis of our economy — a capitalistic society — is founded on the belief that individuals control their own destinies. Working hard and making lasting ties — both personal and professional — are core processes we employ in this country to ensure we all prosper. If we lose our trust and yield to these trends in society, we may lose our chances of accomplishing our American Dream. A reversal of these trends in contemporary society must occur to guarantee each of us our American Dream.

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A Study of the Relative Effects of Enzyme-inducing, Non-inducing, and Enzyme Inhibitor AEDs on Bone Density

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Epilepsy is a neurological condition that makes people susceptible to seizures. A seizure is a change in sensation, awareness, or behavior brought about by a brief electrical disturbance in the brain. Epilepsy is one of the most common disorders of the nervous system. It affects people of all ages, races, and ethnic backgrounds. More than 2.5 million Americans are living with epilepsy.¹ Dr. Kore Liow, epileptologist at the Via Christi- St. Francis Medical Center in Wichita, Kansas, estimates that there are approximately 45,000 epileptic patients in the state of Kansas.

Summary

There are a variety of mechanisms and techniques that are being used and discovered to stop or reduce epileptic episodes. Some of the techniques range from surgical procedures to special diets that regulate the amount of protein, carbohydrates, and fats that are consumed on a daily basis. The most common technique recommended to epileptic patients is a wide assortment of drugs called antiepileptic drugs (AEDs). AEDs are used in an attempt to suppress and ultimately stop the seizures. A review of previous studies indicates that some researchers have found that AEDs may cause severe side effects. One major concern is the side effect of the loss of bone density in the body. Loss of bone density ultimately may lead to osteopenia, which may lead to osteoporosis. Osteoporosis is a condition which causes brittle bones and greater tendencies toward fractures due to decrease in calcium in the bone. Vestergaard, Tigarán, Rejnmark, Tigarán, Mosekilde (1999) found that people who have epilepsy have an increase rate of fractures, which may be due to the side effects from taking the AEDs.²

Due to significant concerns regarding bone density in epileptic patients, measuring bone minerals in the body is an important factor to consider when prescribing AEDs to epileptic patients. The Dual Energy X-ray Absorptiometry (DEXA) is a clinically proven method of measuring bone mineral density (BMD). The goal of the absorptiometry is to measure patients' bone mineral density

¹Epilepsy Foundation. <http://www.epilepsyfoundation.org/answerplace/About-Epilepsy.cfm>



accurately. Bone density measurements then are compared to control population standards to help exam possible locations of osteoporosis and other diseases associated with abnormal bone mineral density.³ Due to lack knowledge and understanding on how AEDs affect bone mineral density, only about 33% of physicians discuss with their patients the possibility of bone loss.⁴ Of those physicians who do understand the affects of AEDs on bone loss, the common recommendation is that DEXA bone scans take place to analyze the BMD, z-score (unit of standard deviation from the mean represented by age, sex, and height-matched controls) and t-score (unit of standard deviation from the mean for BMD compared to healthy 35-year-old individuals presumably at peak bone mass) of the femoral neck on both left and right hips and the lumbar spine, usually L-2 to L-4.⁵

Overview of the Research

The research team at Via Christi- St. Francis Comprehensive Epilepsy Center consists of three undergraduates and a first year medical student, at Kansas University Medical School in Kansas City, Missouri. The research focuses on examining the virtual affects of different groups of antiepileptic

drugs on bone density. More specifically, I investigated and compared the effects of enzyme-inducing, non-enzyme-inducing and enzyme inhibitor AEDs on bone density. To assess this event, DEXA bone scans of the femoral neck and spine will be utilized by reviewing approximately 130 patients' charts, retrospectively. All of the patients have been on AEDs for at least two years and fall in the age range of 12 to 89 years of age. From my study of how enzyme-inducing, non-enzyme-inducing and enzyme inhibitor AEDs affects the bone loss, I would like to discover which AEDs will be most effective without increasing the patient's chances of having osteoporosis due to their medication. The mechanism driving the process is that the enzyme-inducing AEDs will increase the hepatic cytochrome P-450 enzymes which can increase the conversion of 25-hydroxy vitamin D precursor found in the liver to inactive polar metabolites leading to hypovitaminosis D and other bone disorders and ultimately decrease the absorption of calcium to increase bone loss.⁶ This retrospective chart review is the most feasible and noninvasive way to get the information that is needed for my study. All procedures were reviewed by the Internal Review Board (IRB) and approval was received to proceed with the research.

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⁵Pack. 126.

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