Florida A&M University
The Center for Faculty Development & Research

1st Annual Research Summit

March 25-27, 2009
Proceedings of the 1st Annual University Research Summit
“Building Research Capacity Through Collaborations”

A Title III Sponsored Activity
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1st Annual University Research Summit

March 25-27, 2009

A collaborative effort of:

The Center for Faculty Development & Research (CFDR)

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The FAMU Division of Research

The College of Pharmacy and Pharmaceutical Sciences
Preface

This *Faculty Research Proceedings* is intended for a general audience of scholars who may find interest in the variety of research conducted by the faculty of Florida Agricultural and Mechanical University. Included in this publication are research conducted by university faculty from several disciplines.

All faculty papers displayed in this first publication are presented in their entirety, unedited, with the permission of the author. It was the opinion of the University Research Committee that more planning, support and permission would be required to implement a refereed process. Therefore, faculty papers included in this publication have not undergone any type of professional review. However, with the promise of additional support, it is the goal of the University Research Summit Committee that all future publications will undergo a refereed process.

This publication could not have been possible without the encouragement and support of the faculty this great university. The faculty of Florida A&M University is to be applauded their efforts both in and outside the classroom. We sincerely believe that "no university is greater than its faculty!"

Finally, we hope that you will enjoy reading the dynamic research and ideas expressed by the various faculty authors. It has been the privilege of the Center for Faculty Development & Research (CFDR) to prepare this publication.
In higher education, faculty members often work in isolation, even within their academic departments. These departments are often more fragmented than united in purpose. Research reveals that universities with more collaborative environments demonstrate greater faculty productivity across academic disciplines. This article seeks to introduce the 2009 Faculty Research Summit, hosted by the Center for Faculty Development & Research, and to share a conceptual design to encourage greater collegial interaction among faculty members toward building the overall collective research capacity of the university.

Introduction

The 2009 1st Annual Research Summit was developed though the collective vision and cooperative efforts of the Center for Faculty Development & Research (CFDR) and Teachers for a New Era (TNE). The research summit was held on March 26-27, 2009, in the College of Pharmacy & Pharmaceutical Sciences Building, on the campus of Florida A&M University, Tallahassee, Florida. The purpose for the research summit was to encourage greater faculty collaboration. In the State University System, Florida A&M University consistently ranks high in faculty research and grant production; however, this overall success is not shared across all academic disciplines. Consequently, the 2009 1st Annual University Research Summit was initiated to afford faculty from all academic disciplines an opportunity to share their interests, ideas, and knowledge in a collegial atmosphere to build the overall research capacity of the University.
Occasions on which faculty share research and information are scarce, especially, considering how often a conversation might occur with a colleague outside a faculty member’s own discipline. Most higher education arrangements are not designed to maximize faculty interaction, but rather are individually compartmentalized. Aside from an occasional office visit by a colleague or chance discussion at a department meeting, there are few opportunities for faculty to openly discuss a learning or research topic with each other in a collegial manner.

The strategy of the 2009 1st Annual University Research Summit was to give faculty an opportunity to mentwork with each other. Mentwork(ing) is defined as simultaneously mentoring and networking toward collaborative improvement. The underlining concept of mentworking is the sharing of knowledge and opportunity. Once implemented, a strategic mentworking initiative enhances research collaboration within the institution by providing faculty members with increased opportunities to interact with a broader range of faculty members with complementary interests. It is the assumption of this writer that an increase in faculty interaction will lead to the development of new research ideas, an increase in research opportunities within all academic disciplines, and enhanced academic program sustainability.

Faculty Development

Faculty development research consistently cites the development of the collegial organization or culture as necessary to promote collaboration. Further, an essential component of a collegial organization is mentoring and appropriate modeling by leaders within academic units. If an organization’s purpose is to encourage faculty
members to collaborate to accomplish both individual and group goals, it is likely to succeed to the extent that individuals in leadership positions model the role of collegial behavior and create an atmosphere in which positive, collaborative behavior thrives (Rakes, 1994).

Table 1, adapted from Knowles (1990), summarizes administrative behaviors that can encourage or discourage collegial behavior among faculty members. It illustrates four dimensions and characteristics of a collaborative organization: organization, communication/climate, leadership, and decision/policy making. Each dimension aims to increase the organization’s capacity to serve its customers, employees, and intellectual capital investment. This design advocates changes intended to:

1. Increase employee ownership of, and involvement in, the organization and the accomplishment of its goals.
2. Make decision-making processes more transparent and more disciplined.
3. Decrease the influence of position power and increase the influence of expertise in decision making.
4. Increase the organization’s capacity to identify and respond to relevant changes in its environment.
5. Promote learning and the sharing of learning across the organization.
6. Increase both the ability and propensity of members to collaborate within and across levels of the organization.
Table 1. Characteristics of Closed and Collaborative Organizations

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Characteristics</th>
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<tbody>
<tr>
<td></td>
<td>Closed</td>
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<tr>
<td><strong>Organization</strong></td>
<td>▪ Rigid—much energy devoted to maintaining permanent departments, committees.</td>
</tr>
<tr>
<td></td>
<td>▪ Adherence to tradition; reluctance to change.</td>
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<tr>
<td><strong>Communication/Climate</strong></td>
<td>▪ Task-centered.</td>
</tr>
<tr>
<td></td>
<td>▪ Impersonal, cold, formal, reserved; suspicious.</td>
</tr>
<tr>
<td></td>
<td>▪ Restricted flow.</td>
</tr>
<tr>
<td></td>
<td>▪ One-way; downward.</td>
</tr>
<tr>
<td></td>
<td>▪ Emotions repressed, hidden.</td>
</tr>
<tr>
<td></td>
<td>▪ Isolation.</td>
</tr>
<tr>
<td></td>
<td>▪ Generational inequity.</td>
</tr>
<tr>
<td><strong>Leadership</strong></td>
<td>▪ Control of faculty through coercive power.</td>
</tr>
<tr>
<td></td>
<td>▪ Cautious—low risk taking in order to avoid errors.</td>
</tr>
<tr>
<td></td>
<td>▪ Emphasis on personnel selection.</td>
</tr>
<tr>
<td></td>
<td>▪ Self-sufficient; closed system regarding sharing resources; emphasis on conserving resources.</td>
</tr>
<tr>
<td></td>
<td>▪ Low tolerance for ambiguity.</td>
</tr>
<tr>
<td><strong>Decision/Policy-Making</strong></td>
<td>▪ High participation at the top; low participation at the bottom.</td>
</tr>
<tr>
<td></td>
<td>▪ Clear distinction made between policy making and policy execution.</td>
</tr>
<tr>
<td></td>
<td>▪ Decision making by legalistic mechanisms.</td>
</tr>
<tr>
<td></td>
<td>▪ Decisions viewed as final.</td>
</tr>
</tbody>
</table>

A qualitative comparison of the characteristics of a closed and collaborative organization is represented in table 1 by the participatory actions exhibited within the organization. Based on research from noted leadership experts, the collaborative organization is a direct reflection of its leader. The collaborative leader is described as one who inspires commitment and action, leads as a peer problem solver, builds broad based involvement, and sustains hope and participation (Pearce and Conger, 2003). In the opinion of this writer, a key word which has not been introduced, but is essential to any collaborative effort, is trust. Building trust both horizontally and vertically within the organization presents a real challenge, but should be a goal of the collaborative leader.

Table 2 displays the results of a 2007 survey conducted by Associated New American Colleges (ANAC) on the level of preparation for career responsibilities reported by early career faculty. The significance of this survey is that it provides us with an idea (generalization) of how new faculty members may view their preparation for handling the various responsibilities within the academy. Specifically, the 2007 ANAC survey examined the level of preparation that early career faculty perceived they had in order to perform major faculty responsibilities at the time they completed graduate school and in their current faculty assignment. The findings reveal that less than a third of respondents considered themselves very effectively prepared for undergraduate teaching upon leaving graduate school, one in five felt they could very effectively articulate a philosophy of teaching based on learning theory, and less than ten percent felt very effectively prepared to advise undergraduates and serve on faculty
committees. In their readiness to use technology in teaching and collaborate across disciplines, one in five and one in four felt very effectively prepared, respectively.

Further, in Table 2, early career faculty perceptions vary by gender on their level of preparation for the faculty career when they finished graduate school. For example, male faculty felt somewhat more very effectively prepared than women to conduct research and slightly more prepared to teach and advise undergraduates and articulate a teaching philosophy. Female faculty felt better prepared than men to serve on faculty committees. Fast forward to current time and a considerably larger percentage of men still feel very effectively prepared to conduct research, teach undergraduates, teach using technology, and articulate a teaching philosophy. A higher percentage of early career women faculty members currently feel very effectively prepared for interdisciplinary collaboration, advising undergraduates, and serving on faculty committees. These low levels of perceived preparation suggest that graduate schools may need improvement with educating future faculty for teaching and other faculty responsibilities. Indeed, only a third of respondents reported feeling very effectively prepared to conduct research.

Several interesting results in Table 2 are the percentages of early faculty in the areas of interdisciplinary collaboration and obtaining grants, which report an average for after graduate school of 20% and an average of currently working of 14%, respectively. The areas of interdisciplinary collaboration and obtaining grants suggest that collegiality and cooperation should be addressed at the university level. The results
of the 2007 ANAC survey support the need for a faculty development program that addresses specific faculty career responsibilities.

Table 2. Level of Preparation for Career Responsibilities Among Early Career Faculty

<table>
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<th>After Graduate School</th>
<th>Currently Working “Effectively”</th>
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<tr>
<td></td>
<td>% “Very Effectively”</td>
<td>% “Effectively”</td>
</tr>
<tr>
<td></td>
<td>Prepared</td>
<td>All</td>
</tr>
<tr>
<td>Conduct Research</td>
<td></td>
<td>33%</td>
</tr>
<tr>
<td>Teach Undergraduates</td>
<td></td>
<td>31%</td>
</tr>
<tr>
<td>Interdisciplinary Collaboration</td>
<td></td>
<td>25%</td>
</tr>
<tr>
<td>Teaching Using Technology</td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>Articulate Teaching Philosophy</td>
<td></td>
<td>19%</td>
</tr>
<tr>
<td>Serve on Faculty Committees</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>Advise Undergraduates</td>
<td></td>
<td>8%</td>
</tr>
<tr>
<td>Obtain Grants</td>
<td></td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: Associated New American Colleges (ANAC) Survey of Early Career Faculty (2007)

Summary

The myriad of challenges faced by Florida A&M University are not very different from most universities in the State of Florida and across the nation. Of particular interest is the challenge that all universities have with attracting and retaining strong faculty. This challenge of building a world class faculty is even greater for Historically Black Colleges and Universities (HBCUs) like Florida A&M University, who have very limited financial resources to complete the task. A strategy to be considered for HBCUs is to maximize its collaborative opportunities within the organization.

Beyond the many reforms in graduate education programs\(^1\) in recent years, early career faculty have been forced to learn on the job, with limited assistance from institutional initiatives, departmental performance evaluations, and feedback.

\(^1\) Graduate Education Programs refer specifically to those with a required doctoral residency.
Fortunately, many colleges and universities have stepped up with professional
devvelopment support and appropriate socialization, causing most early career faculty to
feel that they are performing effectively by their third or fourth year of service
(Sorcinelli, Mary Deane, et al., 2006). The problem which may arise from not having
better graduate education programs for potential faculty and with not having a formal
university faculty development program is the tenure trap. For tenure earning faculty, if
they wait until the third of fourth year of service to gain a feeling of effectiveness, it
may be too late to demonstrate the level of scholarship necessary to gain tenure. As
stated earlier, the need to develop a university climate of collaboration is essential to
support the needs of faculty.

The 2009 1st Annual University Research Summit showcased a variety of faculty
researchers across academic disciplines. There were over 32 presentations and 143
participants at the 2009 1st Annual University Research Summit. The summit was
opened by Dean Henry Lewis, College of Pharmacy and Pharmaceutical Sciences, who
energized the audience by his remarks on the significance of Florida A&M University as
being the largest single employer of African Americans in the State of Florida. The three
keynote speakers for the research summit included, G. Dale Wesson, Interim Vice
President for Research (FAMU), Lawrence Morehouse, Ph.D., Associate Professor
(University of South Florida) and President and Chief Operating Officer of the Florida
Education Fund, and Ewart Thomas, Ph.D., Professor (Stanford University) and noted
Mathematician of the African Diaspora. Additionally, there were six featured panels
composed of university faculty who contributed to the discussion on the topic, How to
build research capacity through collaboration at the university. Research posters were showcased in the lobby by several graduate students. One selected comment taken from the 2009 1st Annual Research Summit’s participant evaluation forms suggested a need for greater engagement between university faculty and the national research laboratories. A summit participant wrote, “It would greatly benefit the university if more faculty would participate in National Laboratory Research. The knowledge gained by faculty would greatly enhance the collective research capacity of the University.”

Heifetz and Linsky (2002) reported that breaking down the barriers that discourage collaboration by faculty is probably the most needed change in higher education. Ron Heifetz describes this responsibility of a leader when he writes: “To lead is to live dangerously because when leadership counts, when you lead people through difficult change, you challenge what people hold dear – their daily habits, tools, loyalties, and ways of thinking – with nothing more to offer perhaps than a possibility.”

An earlier 2009 survey of faculty needs conducted by this writer revealed that before faculty can be mobilized, their need for career advancement, resource support, and peer recognition must be addressed (Gavin, 2009). The development of programmatic initiatives to support faculty is the purpose for CFDR.

The Center for Faculty Development & Research (CFDR) recognizes that within the academy, there are certain attributes and barriers that may tend to impede the

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2 National laboratories perform research and development that is not well suited to university or private sector research facilities because of its scope, infrastructure, or multidisciplinary nature, but for which there is a strong public and national purpose.
process of creating an institution that models collaboration. Thus, CFDR is committed to working with all university divisions (Academic Affairs, Student Affairs, and Research) to model the six principles of successful collaboration. Morreale and Howery (2002) present the six principles of success collaboration as (1) identify the right issue or area of concern, (2) involve the right stakeholders, (3) communicate common ground principles, (4) negotiate and articulate roles and responsibilities for participants, (5) provide a win/win situation, and (6) minimize competition. For collaboration to be successful, all components of the university must effectively work together.

**CFDR Model**

Figure 1 is a model of the Center for Faculty Development & Research (CFDR). The CFDR uses a train(ing) and share approach designed to value the expertise of faculty who have acquired knowledge through research, teaching, and/or participation in conference activities. This model acknowledges the scholarship of university faculty and attempts to transport learning outward, toward building the collective intellectual capacity of the University. The CFDR supports faculty development through university-wide seminars, workshops, conferences, and faculty forums designed to promote collaboration.
Conclusion

The purpose of this paper was to initiate a dialogue on the value of encouraging a more collaborative university environment to share a conceptual design to encourage greater collegial interaction among faculty members. It was suggested throughout this paper that faculty collaboration would produce both economic and academic benefits for the entire university community. A variety of institutional factors were presented as having a positive effect on faculty productivity. The conclusion which can be drawn from this discussion is that the university’s organizational structure, culture, norms, values and reward processes significantly impacts (1) what work gets done, (2) the designs through which work is accomplished, and (3) who participates in productive endeavors.
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REVEGETATION WITH NATIVE GRASS SPECIES FOLLOWING MECHANICAL AND CHEMICAL CONTROL OF COGONGRASS

(I. CYLINDRICA L.)

Oghenekome U. Onokpise¹, Susan K. Bambo¹, James J. Muchovej¹ and Janet Grabowski²

¹ College of Engineering Sciences, Technology and Agriculture, Florida A&M University, Tallahassee, FL 32307. ² USDA-NRCS Plant Material Center, Brooksville, Florida 34601.

Abstract

Invasive exotic plant species such as I. cylindrica are detrimental to the ecosystems in the southeastern USA. Imperata cylindrica is an invasive exotic weed that has generated serious problems in a variety of habitats. It has been shown to withstand harsh environmental conditions by maintaining a dense rhizome system and displacing native vegetation thus affecting the biodiversity and productivity of natural and planted forests in the Southeastern USA. Management measures for cogongrass have involved mechanical, biological, cultural, preventive, chemical, and integrated approaches. Although, chemicals provide excellent suppression of cogongrass, it is short-term and I. cylindrica eventually re-infests the area due to lack of perennial plant cover. A key to long-term cogongrass management should involve integrated management involving revegetation with perennial native plant species. Information on revegetation and the herbicide tolerance of native plant species is limited. The purpose of this study is to use native perennial grass species for revegetation into cogongrass treated areas and to investigate which species would easily established. The study hypothesized that revegetation with native grass species after chemical treatment would ensure longer control of cogongrass than after mechanical control. Field experiments were conducted between 2007 and 2008 in north Florida. Native grass species, muhlygrass (Muhlenbergia capillaries (Lam) Trin.), maidencane (Panicum hemitomon Schult.), and switchgrass (Panicum virgatum L.) were raised in the greenhouse for eight weeks. Field plots were planted with these natives after two weeks of glyphosate applications and mechanical (plough) treatment of naturally infested areas. The experiment was a randomized complete block design with three treatments and three replicates. Treatments applied to suppress cogongrass included glyphosate, plough, and control (mowed). Plots were evaluated every four months after field planting for native grass survival and percentage cogongrass re-infestation. Data collected was converted into percentages. Data was analyzed using the SAS statistical software package. Results indicated that native grass species survival rate decreased with time irrespective of the treatment. Of the treatments, control had the least survival rate of 30 to 50%, 0 to 2%, and 21 to 42% for switch, maidencane, and muhlygrass, respectively. Survival rates for switch, maidencane, and muhlygrass were 67 to 78%,
15%, and 89 to 93%, respectively in glyphosate treatments. In mechanical treatment, native species survivals were 79 to 82%, 79 to 87 and 38 to 43% for switch, maidencane, and muhlygrass, respectively. Best survival (42%) of maidencane occurred in mechanically treated plots. Survival rates of muhlygrass were highest and similar in both mechanical and glyphosate treatments. Switchgrass had similar survival rates in both mechanical and glyphosate treatments, but higher than control treatment. Re-infestation was 100% in the control treatment plots, while 0 to 8% for glyphosate. This study reveals that revegetation immediately following glyphosate is best due to its lack of soil activity. Mechanical treatment is good for revegetation, but the rate of cogongrass re-infestation may outgrow the native species. Recommended revegetation species are muhlygrass and switchgrass.

Key words: Imperata cylindrica, revegetation, native grass, biological control

Cogongrass has been known for several decades, in both tropical and subtropical regions of the world, for its detrimental effects on any ecosystem where it establishes. In West Africa, uncontrolled cogongrass results in tremendous losses in major crops such as corn (Zea mays L.), yams (Discorea spp.), cassava (Manihot esculenta Crantz), soybeans (Glycine max (L.) Merr.), and complete crop failure when no additional weeding was carried out in slashed prepared land (Udensi et al., 1999; Avav, 2000).

In the southeastern United States and Gulf States region, cogongrass is not a problem in intensively managed agricultural lands whose normal operations include repeated tillage and herbicide applications. However, cogongrass is a serious problem on disturbed lands such as rangelands, pastures, roadsides, reclaimed phosphate mines, and natural areas (Dickens, 1974). In these environments, cogongrass has spread over wide areas, suppressing and displacing desirable native vegetation and changing the land to a dominant monoculture stand of cogongrass (Hubbard et al., 1944; Bryson and
Carter, 1993; Terry et al., 1997). The uniqueness of cogongrass invasiveness varies from agronomic production systems to forest communities.

Several survival strategies that enable cogongrass to spread and persist include persistent, large, rhizome mass, adaptation to poor soils, drought tolerance, prolific wind disseminated seed production, fire adaptability, and high genetic plasticity (Holm et al. 1977; Dozier et al. 1998). Both cogongrass seeds and rhizomes disperse the plant widely. While seedlings are only able to invade open patches in disturbed habitats, rhizomes can persist in both disturbed and established populations (Tominaga 2003). Rhizomes provide a tremendous amount of biomass for regeneration after foliar loss through burning, grazing, frost, or mowing (Lee, 1977). The branched rhizomes form a dense mat able to exclude most other vegetation.

Cogongrass has received extensive research attention and some of the control measures have included mechanical, chemical, biological, and integrated treatments (Shilling and Gaffney, 1995; Dozier et al., 1998). Different levels of success were achieved with each method in different systems. For example, in West Africa, the use of cover crops such as velvetbean \([Mucuna cochinchinensis\) (Lour.) A. Chev] and kudzu \([Pueraria phaseoloides\) (Roxb.) Benth] in combination with handweeding and chemical application was successful in cassava production systems (Akobundu and Ekeleme, 2000; Akobundu et al., 2000; Chikoye et al., 2001, 2002). However, a similar approach in maize cover crops caused a reduction in grain yield. In Indonesia, tree crops such as acacia \([Acacia mangium\) Willd.], Eucalyptus \([Eucalyptus spp.,\) and rubber \([Hevea spp.]\)
have been used to control cogongrass; nevertheless, intensive mechanical site preparation is essential to facilitate establishment (Otsamo et al., 1995; Bagnall-Oakeley, et al., 1996). In addition, suggestions for fast-growing exotic trees such as *A. mangium*, or a high proportion of evergreen woody vegetation that will provide grass competition, and enhance secondary succession toward natural forest has been made (Kuusipalo et al., 1995; Otsamo, 2002). Following this suggestion, research in Indonesia with fast-growing exotic tree species such as *Acacia mangium* (Willd.), *Gmelina arborea* (Roxb.) and *Paraserianthes falcatoria* ((L.) I. Nielsen) provided rapid restoration of forest ecosystems (Kuusipalo et al., 1995; Tuomela et al., 1996; Turvey, 1996; Otsamo et al., 1997; Otsamo, 2000). The idea was to eliminate cogongrass, so that native species begin to establish in the understory and enhance secondary succession toward natural forest.

In the southeastern USA, tree species that dominate many natural ecosystems such as pine (*Pinus spp.*), oak (*Quercus spp.*) and other hardwood species have been reported to be poor competitors with cogongrass even in combination with herbicide applications (MacDonald et al., 2001; Ramsey et al. 2003). Several researchers have recognized the need for revegetation as a component of cogongrass management in the southeastern U.S. (Johnson et al., 1997, 2000; MacDonald et al., 2002). Faircloth (et al., 2003; Onokpise et al 2007) integrated cover crops, mowing, and chemical applications for cogongrass management along rights-of-way. The authors reported that cover crops between fall and spring herbicide applications were inconsistent in controlling cogongrass, mowing had no affect, and herbicide applications followed by revegetation
with bahiagrass (*Paspalum notatum* Fluegge), and common bermudagrass (*Cynodon dactylon* (L.) Pers.), provided excellent control, but success was location specific. Barron *et al.* (2003) also reported that integrated control of imazapyr followed by bahiagrass (*Paspalum notatum* Fluegge.) establishment provided good cogongrass control, but diskng had no impact on cogongrass control in combination with herbicides. Additional research is needed to determine the practices necessary to optimize the selection and establishment of desirable plant species for revegetation.

Sustainable management of cogongrass requires an integrated approach that involves a long term control. An integrated management strategy using all available methods of control is needed to effectively manage cogongrass. The tactic is to replace cogongrass, not just eradicate it. If a replacement plant species does not fill the niche occupied by cogongrass after suppression then cogongrass will simply re-infest the area. Potential research that would improve management of cogongrass-infested lands includes evaluation and improvement of species for revegetation purposes. The purpose of this study was to use native perennial grass species for revegetation of cogongrass treated areas and to investigate which species could easily establish. The authors hypothesized that revegetation with native grass species after chemical treatment would ensure long-term control of cogongrass better than after mechanical control.
Materials and Methods

The experiment was conducted in 2007 and 2008 on a cogongrass infested right-of-way site in Tallahassee, Florida (30.38° N and 84.37° W with an elevation of 57 m). Annual rainfall averages 1,600 mm and the average daily minimum and maximum temperatures are 12.8 °C and 26.1 °C, respectively, with an average temperature of 19.5 °C. The soil series is Lakeland and soils are thermic, coated Typic Quartzipsamments. Before the study, the site was maintained by the Florida Department of Transportation who carried out periodical mowing to keep the high way in proper conditions. Native grass species used as competitive species included muhlygrass (*Muhlenbergia capillaries* (Lam) Trin.), maidencane (*Panicum hemitomon* Schult.), and switchgrass (*Panicum virgatum* L.). These plants were raised in the greenhouse for eight weeks and field plots were planted with these natives after applying treatments to naturally infested areas to suppress cogongrass.

Treatments included glyphosate application, mechanical tilling (plough), and mowing (control) treatments. The experiment was a randomized complete block design with three treatments: glyphosate, ploughed and mowing, and three native grass species: muhlygrass, maidencane, and switchgrass, resulting in eight treatment combinations and three replicates. The whole experimental area was moved on 6th August 2007. On 26th August 2007, plough or disking was applied to the plot designated for this treatment. Glyphosate was applied on July 27, 2007, to all plots designated for this treatment at a rate of 1.8 kg a.i. /ha or 26 gallon /ha. Each treatment plot was a
strip of 40 x 3 m, with a 2 m border between strips. Native grass species were planted two weeks after disking and herbicide application in eight combinations. The experimental unit was 1.0 x 1.0 m plot, located at the center of the 3 m wide strip.

Plots were evaluated every four months after field planting for native grass species survival and cogongrass re-infestation. Percentage cogongrass re-infestation was monitored by rating visually the amount of cogongrass cover in the planted 1.0 x 1.0 m plot. Data collected was transformed into percentages and was analyzed using the SAS statistical software package (SAS 2003). One-way analysis of variance (ANOVA) was conducted using PROC GLM. Differences between treatment means were calculated using Tukey's honestly significant difference procedure at $P < 0.05$.

Results and Discussions

Survival of Native Grass Species

Native grass species survival rate slightly decreased with time irrespective of the treatment about twelve months after field planting. However, significant decreases over time were found only in mowing treatment. Variability occurred with respect to native grass species within the treatments ($P < 0.001$). The performance of established native species indicated that once native grass is established it may be able to maintain itself. This is because there was only 5% or less decrease from the first plant survival rating to the twelve months after planting.

Maidencane had poor survival rate irrespective of the treatments (Figure 1). The highest seedling survival of maidencane was only 38% and this occurred in mechanical
treatment. No survival was recorded in mowing treatment. Throughout the sampling period, mechanical treatment was higher than the mowing treatment, but the plots that were treated with glyphosate showed a constant survival rate (Figure 1). The poor survival rate of maidencane may be attributed to the state of soil moisture during establishment because maidencane is known to establish quickly in wet ecosystems (Ref.).

Survival rates of muhlygrass were highest and similar in both mechanical and glyphosate treatments and were higher than those in control of mowing treatment throughout the sampling period ($P < 0.001$). Survival rates in mechanical treatment decreased from 87% at four months after planting to 79% at the end of twelve months, but this decrease was not significantly different (Figure 2). Likewise, muhly planted in glyphosate plots had the best survival rate. The rate was similar (ranged from 89 to 893%) throughout the sampling period. Initial survival rates in mowed plots was less than 42% and significantly reduced to 21% (Figure 2). Mowing did not suppress cogongrass enough to allow native grass species to establish.

Switchgrass had similar survival rates in both mechanical (79 to 82%) and glyphosate (76 to 78%) treatments (Figure 3). However, these treatments were higher than the control (30 to 51%) treatment ($P < 0.01$). Switchgrass seems to withstand the pressure from cogongrass even in mowing treatments. This may be due to its growth habit which is described as tough, long-lived, warm-season perennial bunch grass. It has been reported to grow well under a wide range of conditions (Moser and Vogel
Eussen and Wirjahardja (1973) reported that plants which survive competition with cogongrass have a deeper root system than that of cogongrass and/or a taller canopy. On the other hand switchgrass is capable of reaching 2.4 m in height with an extensive root system with some roots as long as 2.2 m (Sanderson and Reed, 2000).

**Treatment Effects and Cogongrass Re-infestation**

Out of the treatments, mowing had the least survival rate of less than 50% for the native grass species. The mechanical and glyphosate treatments resulted in very good survival rate in switchgrass and muhlygrass species. The low survival rate of native grass species in mowing treatment was not surprising as mowing cogongrass is only effective in removing the aboveground foliage (Sajise, 1972). Cogongrass re-infestation was 100% twelve months after treatment. Although Willard and Shilling (1990) reported that total rhizome mass of cogongrass were reduced when mowing was scheduled on a monthly basis, the fact that the grass remained viable will result in greater competition with native species if present. Burnell et al. (2003) found that weekly mowing of cogongrass may reduce the number of plants per unit area by 74%, but cogongrass resprouted at the end of two consecutive seasons of treatment.

Mechanical treatment showed very good results in revegetation of native grass species. However, re-infestation of cogongrass rose from 4% at four months to 36% at twelve months (Figure 4). Studies showed that mechanical treatment such as tillage would be effective only when repeated regularly (Johnson 1999). However, in the case of revegetation with native grass species, the repeated option is not feasible if the goal is
to establish native plant species at the initial treatment. In many ecosystems mechanical
treatment may not be economically sound as such practices may not be compatible with
the topography (Van Noordwijk et al., 1996). Although deep tillage (8 cm) may control
cogongrass by inverting, burying, or exposing rhizomes, it is not always feasible on a

Native grass species survival rate in glyphosate treatment plots gave the best
results. There was an indication that the lack of competition between the native and
cogongrass resulted in easy establishment of these species, especially when compared
to the mowing treatment that resulted in no suppression of cogongrass. Glyphosate is
one of the herbicides used effectively for cogongrass management (Udensi et al., 1999;
Barnnet et al. 2001). Miller (2000) showed that glyphosate can provide good control of
cogongrass for a year after application. This was evident with this study, because after
one year there was very little re-infestation (8% maximum) of cogongrass in these plots
(Figure 4). Integrated management of cogongrass that involves mowings/discings in
combination with a single glyphosate application has been demonstrated to reduce
rhizome biomass by at least 80% one year after treatment (Willard et al., 1996). To
eradicate the re-infestation of cogongrass, it has been suggested that spot treatments to
actively-growing infestations is required (ALDOT 2002). It is therefore essential that
 revegetation with desired plants species be carried out as soon as possible to fill the
niche occupied by cogongrass after suppression. Potential research that would improve
management of cogongrass-infested lands will be the continuous evaluation and improvement of species for revegetation purposes.

Conclusions

A greater attention in the southeastern US is now focused on controlling cogongrass on disturbed lands such as rangelands, pastures, roadsides, reclaimed phosphate mines, and natural areas. The negative impact of cogongrass has been recognized and many studies have focused on eradication of cogongrass. The uniqueness of this study is that it focuses not just on eradication of cogongrass, but also on evaluating potential perennial native grass species for revegetation after suppression. This study reveals that revegetation immediately following glyphosate is best due to its effective suppression of cogongrass and the low re-infestation rate. Mowing did not suppress cogongrass and resulted in poor survival rates of revegetation species. Mechanical treatment suppressed cogongrass and allowed revegetation of native grass species. However, the rate of cogongrass re-infestation was large and may out perform the native species in the near future. The dry field conditions during native grass species planting was more favorable to muhlygrass and switchgrass than maidencane. The low survival rate of maidencane remains inconclusive and may not be reflective of the treatments that were applied or its survival potential. Detailed examination of cogongrass below ground is essential to fully understand the cogongrass re-invasion after applying treatments. Desirable characteristics of revegetation species include quick and easy survival and establishment followed by rapid canopy formation, a perennial habit, the ability to re-
establish from seed each season, tolerance to commonly-used herbicides for cogongrass control, and strong growth in a limited-input system. This research has increased the understanding of plant-herbicide interactions and management practices aimed at controlling cogongrass.
List of Figures

1. Figure 1. Survival rate of maidencane from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.

2. Figure 2. Survival rate of muhlygrass from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.

3. Figure 3. Survival rate of switchgrass from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.

4. Figure 4. Cogongrass re-infestation rate from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.

Figure 1. Survival rate of maidencane from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.
Figure 2. Survival rate of muhlygrass from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.

Figure 3. Survival rate of switchgrass from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.
Figure 4. Cogongrass re-infestation rate from four months through twelve months after treating naturally infested cogongrass plots by applying mowing, mechanical, and glyphosate treatments. The same letters in a group of bars is not significantly different.
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Effect of Natural Organic Matter on Arsenic Removal from Drinking Water

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Introduction

Arsenic is a highly toxic and carcinogenic element. Drinking water is one of the major sources of arsenic exposure to the human population. Elevated arsenic concentration in groundwater has been reported worldwide, most recently in Bangladesh, Vietnam, India, and Nepal. Long term exposure to arsenic can cause various types of cancers including skin, liver, lung, kidney and neurological disorders. The drinking water standard for arsenic is 10 µg L\(^{-1}\) (1). In natural water arsenic primarily occurs in two oxidation states +III (arsenite) and +V (arsenate). As(III) is usually a predominant form in the contaminated groundwater. As(III) is more toxic and difficult to remove from water than As(V). In previous studies the authors found that combined use of potassium ferrate (K\(_2\)FeO\(_4\)) and aluminum chloride salts efficiently reduced arsenite concentration from 500 µg L\(^{-1}\) to < 10 µg L\(^{-1}\) (2). The effect of organic matter on arsenic removal is a topic of keen interest because of the ubiquitous nature of natural organic matter in aqueous systems. Previous studies reported that NOM adversely affected the arsenite and arsenate removal by iron oxy/hydroxides (3, 4). The present study was undertaken to evaluate the effect of NOM on the removal of arsenite in water by Fe(VI)/Al(III) salts and the influence of pH on these processes. In addition,
the authors also intended to determine the optimum molar ratio of arsenite to Fe(VI)/Al(III) for effective removal of arsenite in the presence of natural organic matter.

**Materials and Methods**

*Synthesis of Potassium Ferrate*

Potassium ferrate ($\text{K}_2\text{FeO}_4$) was synthesized by hypochlorite oxidation of ferric nitrate using the method of Thompson et al. (5). A molar absorption coefficient, $\varepsilon_{510 \text{ nm}} = 1,150 \text{ M}^{-1} \text{ cm}^{-1}$ was used for the calculation of Fe(VI) concentrations.

*Effect of Natural Organic Matter on the Arsenite Removal*

Three different types of NOM were used in this study. These are Suwannee River NOM (SWNOM), Nordic Reservoir NOM (NRNOM), and Humic acid. SWNOM and NRNOM were obtained from the International Humic Substance Society (University of Minnesota, St. Paul, MN) and Humic acid was obtained from Aldrich. All the NOM samples were dissolved in deionized water and then filtered through a 0.45 µM membrane filter. The dissolved organic carbon (DOC) concentration in the filtrate was analyzed using TOC-V analyzer, Shimadzu. The batch experiments were conducted with a background electrolyte of 0.01 M NaCl solution containing 500 µg L$^{-1}$ arsenite and various concentrations of NOM (1, 2, 4, 8, and 10 mg C L$^{-1}$). The samples were equilibrated with potassium ferrate (20 µM) and aluminum chloride (20 - 314 µM) solution for 24 h. The pH was adjusted to the desired pH with the addition of KOH. The final pH was measured and the samples were filtered using 0.20 µm pore size
membrane filters. The effect of NOM on arsenite removal in drinking water was also carried out in a similar way as described above.

**Arsenic Speciation Analyses**

Arsenic analysis was performed using an Atomic Absorption Spectrophotometer (Analyst 300 AA, Perkin-Elmer Corporation, Norwalk, CT) coupled with a flow injection analysis system (FIAS-100) and a graphite furnace system (HGA-850). The flow injection analysis system was equipped with an electrically heated quartz cell. An electrode-less discharge lamp was used as a radiation source. The flow injection analysis system was used to analyze arsenite concentrations and total arsenic [As(III)+As(V)] concentration < 10 µg L⁻¹, while the graphite furnace system was used to determine total arsenic concentration > 10 µg L⁻¹. The analytical parameters for the FIAS system were as follows: carrier gas: argon; cell temperature: 900 °C; sample loop: 500 µL; carrier solution: 10% HCl; reducing agent: 0.03% NaBH₄ in 0.05% NaOH (arsenite) and 0.25% NaBH₄ in 0.05% NaOH (arsenite+arsenate). Prior to the determination of total arsenic by FIAS, the samples were reacted with KI and ascorbic acid for at least 1 h before analysis to ensure that all arsenate was converted into arsenite. The method detection limits for total arsenic and arsenite were 0.1 µg L⁻¹ and 0.5 µg L⁻¹, respectively. During the analysis by the graphite furnace system, 5 µL of Pd-Mg-citric acid matrix modifier was used. The method detection limit for total arsenic by graphite furnace was 1 µg L⁻¹. Arsenate concentrations were determined from the difference between total arsenic and arsenite concentrations.
Results and Discussion

The effect of natural organic matter (NOM) at concentrations varying from 1 to 10 mg C L\(^{-1}\) on arsenite removal by Fe(VI)/Al(III) salts at pH 6.5 are shown in Fig. 1. Arsenite was not detected during the speciation analysis of residual arsenic, meaning all the residual arsenic was As(V). The presence of NOM at ≤ 2 mg C L\(^{-1}\) had no significant on the removal of arsenite. However, arsenite removal decreased sharply at > 2 mg C L\(^{-1}\) (Fig. 1). At 4 mg C L\(^{-1}\), Arsenite removal decreased from 99.8% (without C) to 60%, 68%, and 74% with SWNOM, NRNOM, and HA, respectively. The reduction in arsenic removal could result from the competition between arsenic and natural organic matter for surface adsorption sites and the formation of soluble As-NOM complexes (4,6). The higher reduction in As removal in the presence of SWNOM as compared to NRNOM and HA could be attributed to the different functional groups present in these organic matters. At 8 and 10 mg C L\(^{-1}\), arsenic removal was negligible irrespective of the source of OM.

In the case of SWNOM and NRNOM (4 mg C L\(^{-1}\)) about 300 µM Al(III) was required to remove arsenite from 500 µg L\(^{-1}\) to < 10 µg L\(^{-1}\) as compared to ~ 100 µM Al(III) in the case of HA (Fig. 2). Fig. 3 shows the results of arsenite removal in the presence of 4 mg C L\(^{-1}\) as a function of pH. The effect of NOM on arsenite removal was pH dependent. A greater reduction in As removal was observed at pH > 7 especially with HA where the residual As concentration increased from 7.6 µg L\(^{-1}\) at pH 7.5 to 70
μg L$^{-1}$ at pH 8.0. The effects of NOM on arsenite removal at high pH are probably due to the changes in surface properties of Fe-Al oxy/hydroxides.

The results of the removal of arsenite from drinking water (supplied by City of Tallahassee, FL) spiked with 500 μg L$^{-1}$ arsenite and 4 mg C L$^{-1}$ as SWNOM are shown in Fig. 4. At a low concentration of Al(III), NOM spiked sample showed much less reduction in the concentration of As compared with the non-spiked sample. However, no significant differences between samples with and without NOM were observed for removal of As at Al(III) concentration > 100 μM. It seems that at low concentrations of Al(III), functional groups present in organic matter compete with arsenic for sorption sites resulting in less sites available for arsenic removal. However, at higher Al(III) concentrations (>100 μM), sufficient sorption sites are available for removal of arsenic in the water samples containing NOM at 4 mg C L$^{-1}$.

A comparison of Fig. 2 and Fig. 4 shows that in the presence of SWNOM at 4 mg C L$^{-1}$, much lower Al(III) concentration (~100 μM) was required to remove arsenite from drinking water as compared to 300 μM Al(III) required for the NOM spiked background electrolyte. This difference is due to the high concentration of calcium present in drinking water used in this study. The calcium ions has two positive charge which results in the relatively less negative charge on the Fe-Al oxy/hydroxide surfaces and favors the adsorption of arsenic.
Conclusion

Natural organic matter used in this study had a significant effect on the removal of arsenite by Fe(VI)/Al(III) salts when present at concentrations > 2 mg C L\(^{-1}\). High coagulant doses would be required in the presence of DOC to achieve effective removal of arsenic. Arsenic removal was more dependent on concentration and composition of NOM than pH. The effect of NOM on the removal of arsenite from natural waters would be significantly less due to the high amount of calcium especially in groundwater.
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Fig. 1. Effect of DOC concentration on arsenite removal by Fe(VI)/Al(III) salts at pH 6.5. Initial arsenite conc. = 500 µg L\(^{-1}\); Fe(VI) conc. = 20 µM; Al(III) conc. = 34 µM
Fig. 2. Removal of Arsenite by Fe(VI)/Al(III) salts in the presence of DOC at 4 mg C L$^{-1}$. Initial As conc. = 500 µg L$^{-1}$; Fe(VI) = 20 µM; pH = 6.5.
Fig. 3. Effect of pH on arsenite removal by Fe(VI)/Al(III) salts in the presence of 4 mg C L\(^{-1}\). Initial As(III) conc. = 500 µg L\(^{-1}\); Fe(V) conc. = 20 µM; Al conc. = 146 µM.
Fig. 4. Effect of NOM on the removal of arsenite in drinking water by Fe(VI)/Al(III)salts at pH 6.5. [Fe(VI)] = 20 µM and initial As conc. = 500 µg As(III) L⁻¹.

![Graph showing the effect of NOM on arsenite removal](image-url)
Inheritance of Flower Types, Berries Size, and Color in Muscadine Grapes

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Abstract

One hundred and twenty-three F1 hybrids from muscadine grape cvs. Summit x Noble were evaluated for their inheritances of flower sex, fruit color and berry size. The segregation of flower sex followed: 1 perfect and 1 female Mendelian single gene ration. Fruit color segregated in a ratio of one green, six red, and one black which suggests that muscadine fruit color is controlled by three dominant genes. Five hybrids had fruits larger than ‘Summit’, the large fruit parent, but only one of which was a perfect flower. Sixteen vines showed higher sugar content than parent ‘Noble’, the higher sugar content parent. Results from this study indicat that to obtain a desired combination of perfect flowers with large and high sugar berries, requires a large number of F1 populations.

Demands for new muscadine grapes (Vitis rotundifolia) have been increasing in the Southeastern United States where the humid and warm environment limits the production of non muscadine grapes. The industry defines a good cultivar as one that adapts to the local environment and produces enough fruit with desirable qualities. This is the general objectives of a grape breeding program (Reisch and Pratt 1969).

Unlike the V. vinifera grapes, muscadine were formerly dioecious (Detjen 1917, Loomis 1954). Today, more than half of the commercial muscadine cultivars are female flowers, and self-fertile grapes are needed as pollinators. In practice, female cultivars are preferred by breeders since no emasculation is needed. The use of female parents would result in female F1 progenies that do not include desired traits. Inheritance of
muscadine flower types was first reported by Loomis and Williams (1957). Since then, much broader germplasm has been used in muscadine breeding programs.

The genetics of fruit skin color in muscadines has not been fully investigated. Barrit and Einset (1969) proposed two pairs of genes with epistatic action for fruit skin color in Vitis vinifera: B, a dominant gene for black fruit and R, a dominant gene for red fruit. Green grape fruit is considered recessive for both genes (bbrr). However, it is unknown if green grapes are recessive in Muscadine grapes. Large fruit is always preferred in the table grape market. Early work indicates that fruit size of muscadine could be improved through breeding (Reimer and Detjen 1914, Goldy 1992, Williams 1954, Fry 1967) but its inheritance has not been studied.

The objective of this research is to study the inheritance of flower types, fruit colors, and fruit sizes of muscadine grapes.

**Materials and Methods**

The cross between ‘Summit’ (female flower, large green fruit) and ‘Noble’ (perfect flower, small black fruit) occurred at Florida A&M University. Segregation data among the 123 F1 hybrids was collected in 2008. Perfect flowers were discriminated from female flowers by erect stamen during bloom (Fig. 1). Colors of ripened fruits were visually determined as green, red, and black (Fig. 2). The fruit color of ‘Noble’ was considered black and color lighter than ‘Noble’ was considered red. The fruit size and sugar content (SSC %) were determined by five clusters randomly collected from each vine.
Results and Discussions

*Inheritance of Flower Types.* Among the 123 F1 hybrids, 55 were found with perfect flowers while 68 were female flower vines, statistically fitting in the 1:1 Mendelian segregation rule (Table 1). The 1:1 in female perfect flower ratios indicates that the flower sex of muscadine grapes is a qualitative trait and controlled by a single pair of genes similar to previous findings (Detjen 1917, Loomis 1954, Oberle 1938, Loomis 1960). The female perfect flower ratio was 8:10 for green berry vines, 51:38 for red vines, and 9:7 for black vines. According to Levadoux (1947), the hermaphrodite flower (H) is dominant over female (h). The flower genotype of ‘Noble’ can therefore be interpreted as heterozygous Hh, and ‘Summit’ is homozygous hh. Only 50% of perfect flower vines are expected when ‘Noble’ is crossed with a female parent.

*Inheritance of Fruit color.* The 123 F1 hybrids were segregated into 18 green, 89 red, and 16 black, which fits well within the 1:6:1 ratio (Table 2). The ratio of 1:6:1 differed from the mode of berry color segregation observed by Barritt and Einset (1969) in bunches of grapes where the color is controlled by dominant R- (red) or B- (Black) while green berries are recessive rrbb. One possible interpretation for this observation is that there are three pairs of genes controlling muscadine berry colors, with B-- for black, R-- for red, Ra-- for additional red. Muscadine fruits are black with all the three dominant genes appearing (B-R-Ra-). They are green when possessing all three recessive genes (bbrrrrara). While fruit contained any one (Bbrrrara-, bbRrrara, bbrRara) or two (BbRrrara, BbrrRara, bbRrRara) of the dominant genes, the colors are red to some
degree. Based on this interpretation, the fruit color of “Summit” is homozygous bbrrrrara, and the ‘Noble’ is heterozygous BbRrRara.

**Inheritance of Fruit Size.** Fruit varied from 2.8 g to 11.4 g among the 123 hybrids. Among them, 18 plants (15%) produced fruit smaller than the small fruit parent ‘Noble’ (3.5g), and 5 (4%) were larger than the large fruit parent “Summit” (8.7g), while 100 hybrids (81%) were between the parents of “Noble” and “Summit”. The fruit size seems a Quantitative Trait Locus (QTL).

Only one vine with berries larger than ‘Summit’ and also a perfect flower was observed, which was less than 1% of the F1 plants. Among the 123 hybrids, 101 (82%) were smaller than the mean of the two parents (6.1g), while 22 plants (18%) were larger (Table 3). These data suggest that fruit sizes in F1 hybrids lean towards the small-fruited parent, and the numbers outside the range of the parents’ berry size are very low.

This data indicates that the inheritance of flower sex in muscadine grapes is similar to V. vinifera, and is controlled by a single pair of dominant genes. Fruit color could be controlled by three pairs of dominant genes, while the fruit size is a QTL. To obtain a desired trait of large berries, high sugar level, and perfect flowers requires screening large numbers of F1 hybrids.
Literature Cited


Table 1. Segregation and X² analysis of fruit color among Summit x Noble F1 hybrids

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<td>15.3</td>
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p0.005 with df=2 10.60

Table 2. Segregation and X² analysis of flower sex among Summit x Noble F1 hybrids

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<th>X²</th>
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<td>Green perfect</td>
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<td>123.0</td>
<td>2.93</td>
</tr>
</tbody>
</table>

p0.005 with df=5 16.75
Table 3. Variations in fruit sizes (g) among Summit and Noble F1 hybrids

<table>
<thead>
<tr>
<th>Color/flower</th>
<th>vine numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min.-max.</td>
</tr>
<tr>
<td>Green female</td>
<td>8</td>
</tr>
<tr>
<td>Green perfect</td>
<td>10</td>
</tr>
<tr>
<td>Red female</td>
<td>51</td>
</tr>
<tr>
<td>Red perfect</td>
<td>38</td>
</tr>
<tr>
<td>Black female</td>
<td>9</td>
</tr>
<tr>
<td>Black perfect</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>123</td>
</tr>
</tbody>
</table>

z. mean of Summit (8.7g) and Noble (3.5g)
### 2D Voronoi Diagrams

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**Abstract.** Given N points (sites) in the plane (a 1x1 square for simplicity) the authors propose to generate a tessellation of that domain by assigning every point in the plane to its nearest site. This problem from the realm of Computational Geometry offers several interesting issues. On the one hand, it does not lend itself to a formulaic approach but rather calls upon geometric topics such as the notion of proximity with the added twist that resolution in one area can affect far away places. An algorithm, developed by Byers [1], is implemented in Maple. In addition, the topic was introduced to students in the context of a research experience for undergraduates because it presented an interesting problem with an applied flavor as well as fairly simple mathematics that still had to be orchestrated into a subtle whole to yield the needed results.

**Introduction**

The mathematical problem is as follows: Given N points (sites) in the plane (a 1x1 square) the authors propose to generate a tessellation of that domain by assigning every point in the plane to its nearest site. The process, as presented by Byers [1], is to select a particular site, call it C, and determine its Voronoi polygon. This is achieved by:

a) Generating all segments from C to the remaining sites.

b) Considering the perpendicular bisectors of each of these segments (in other words, the normal to the segment through the midpoint).

c) Determining all intersections points of these bisectors.

d) Eliminating those intersection points not in the 1x1 square.

e) Determining which ones of the remaining intersection points are closest to C.
Their convex hull is the Voronoi cell. Repeat the process for each of the remaining sites.

The authors implemented the solution using the Computer Algebra System (CAS) Maple in the course of a Research Experience for Undergraduates taking place on the campus of Florida A&M University. The purpose was to involve the students in the project to understand its mathematics and to participate in the implementation of the algorithm using Maple. The goal was to have students studying alongside faculty and witness the discovery process in all its phases. While the authors did not necessarily look for the most optimal algorithm, they believe that the result is a detailed topic of research that could be used to introduce students to the subject of Computational Geometry and is a stepping stone toward more advanced research topics in Computational Geometry, Computational Biology, and other areas of development. The authors encourage the reader to conduct a Google search on the topic of Voronoi diagrams.

**Byers’ Algorithm**

Initially, select a certain number of random points that will become the sites. For the purpose of a simple illustration choose N = 6. Record the sites’ coordinates and plot them as well in a 1x1 square.

\[N \equiv 6\]

```plaintext
original_list = [[0.4540000000, 0.1440000000], [0.3150000000, 0.4970000000],
[0.1470000000, 0.7430000000], [0.4970000000, 0.7890000000], [0.7300000000, 0.2710000000],
[0.1280000000, 0.5580000000]]
```
The central idea behind a Voronoi diagram as a tessellation is that space is subdivided in cells, each of them surrounding its related site. The members of each cell are closest to the cell’s site than to any other one. Consequently, the cell boundaries will have to be part of perpendicular bisectors to segments joining neighboring sites. First determine the equations of all the perpendicular bisector lines. Then calculate the coordinates of all the points of intersection of these different bisectors, and then determine which of these intersection points belong to the Voronoi diagram. Maintain a copy of the original list of sites in original list. Maintain a running list of sites which will dynamically change through the process.

**Step-by-Step Implementation**

First select one of the original sites (the k-th one) at random, call it C(xc,yc), and let it be the one under scrutiny at the moment. In the upcoming graphics identify it by circling. Determine its Voronoi cell. M will represent the number of sites left, a group
out of which will be extracted the nearest neighbors to $C(x_c,y_c)$. Of course, once the algorithm is fully developed, the following process will be embedded in a loop where the parameter $k$ will assume all $N$ values, $N$ being the number of sites and also the number of Voronoi cells.

$$k = 2$$
$\begin{align*}
x_c &:= 0.3150000000 \\
y_c &:= 0.4970000000
\end{align*}$

$$\text{running list} = {[0.4540000000, 0.1440000000, 0.7430000000], [0.4970000000, 0.7890000000], [0.7300000000, 0.2710000000], [0.1230000000, 0.5580000000]}$$

$$M = 5$$

Next, calculate the equations of the lines that are perpendicular bisectors between $C(x_c,y_c)$, the chosen site, and each of its neighbors (as well as the four boundary lines). Once that is done, calculate all the possible intersection points by solving systems of 2x2 equations in matrix form. The result is a total list of all relevant intersection points as well as their number when attention is focused on site $C(x_c,y_c)$.

$$\begin{align*}
&[[-1.013793309, 0.2301027478], [0.7147678427, 0.4505488105], [0.5161499423, 0.3723394956],
&[0.120015644, 0.2163490580], [0.3321130577, 0.6890528201], [0.8997235425, 1.076689248],
&[0.2575994294, 0.6381654641], [0.5982802873, 0.5231540676], [0.2839844763, 0.7190507714],
&[-0.3448601818, -1.208718918], [-0.4294316547, 0], [2.110136691, 1], [0, 0.1690963173],
&[1, 0.3628640227], [-0.6768371429, 0], [0.7574283714, 1], [0, 0.4622439024], [1, 1.145170732],
&[1.437625374, 0], [-0.1666769230, 1], [0, 0.5960547945], [1, 0.2727671233], [0.3133819277, 0],
&[0.8579602410, 1], [0, -0.5754579646], [1, 1.360825221], [0.04942780740, 0], [0.3756310160, 1],
&[0, -0.1515245592], [1, 2.914049180]]
\end{align*}$$
Next filter out all the points of intersection that are outside of the [0,1] x [0,1] square and see how many are left. 

[[0.7147678427, 0.4505488105], [0.5161499423, 0.3723394956], [0.1200015644, 0.2163490580], [0.3321130577, 0.6890528201], [0.2575994294, 0.6381654641], [0.5962802873, 0.5231540676], [0.2839844763, 0.7190507714], [0.0, 0.1690563173], [1, 0.5628640227], [0.7874285714, 1], [0, 0.462439024], [0, 0.8960547945], [1, 0.2727671233], [0.3133819277, 0], [0.8579602410, 1], [0.04942780746, 0], [0.3756310160, 1]]

Show graphically the situation as it is so far. Draw the sites as well as the bisecting lines and the relevant intersection points that will help determine the Voronoi cell associated with C(xc,yc) (see small circle). Recall that the bisecting lines seen are only the ones involving C(xc,yc) with the rest of the sites. By then, the reader’s eye can determine the edges of the polygonal cell about C(xc,yc).

![Bisectors intersections](image)

**Figure 2: Bisectors intersections**

Now, determine which intersection points, in the filtered list, need to be retained because they are on the same side as C(xc,yc) with respect to the bisecting lines. This is the crux of a second filtering process. An intersection point will be retained if there is no bisecting line strictly between it and C(xc,yc). The intersection point under scrutiny will itself be on a bisecting line. Here are the intersection points left after that second sorting process.
Once more, represent the situation graphically using the remaining vertices as corners of the polygonal cell forming the Voronoi cell. Depending on the point \( C(x_c, y_c) \) being analyzed, it may turn out that the cell is fully contained within the square while, at other times, the boundary will intervene. Therefore analyze subcases since the polygonal contours will be sometime closed (fully contained within the square) and sometimes open (one edge or more will be on the boundary of the square).

\[
\text{candidates} = \begin{bmatrix}
[0.5161499423, 0.3723394956], [0.1200015664, 0.2163490580], [0.3321130577, 0.6890528201], \\
[0.2575994294, 0.6381654641], [0.5982802873, 0.5231540676]
\end{bmatrix}
\]

Here is a technicality. It is necessary to order the vertices in a clockwise manner so as to draw the correct (neighbor to neighbor) polygonal contour. Achieve this by calculating the polar angle for each of the vertices and use these values to order them. Use degrees measurements.

\[
\text{angle} = \begin{bmatrix}
-0.5548073208, -2.178029020, 1.481925044, 1.956995749, 0.09206476312
\end{bmatrix}
\]

\[
\text{sorted} = \begin{bmatrix}
-2.178029020, -0.5548073208, 0.09206476312, 1.481925044, 1.956995749
\end{bmatrix}
\]

\[
\text{corners} = \begin{bmatrix}
[0.1200015664, 0.2163490580], [0.5161499423, 0.3723394956], \\
[0.5982802873, 0.5231540676], [0.3321130577, 0.6890528201], [0.2575994294, 0.6381654641]
\end{bmatrix}
\]

\[N_C = 5\]

It seems that whenever the cell has an edge on the boundary (whether along an edge or in a corner) all that is necessary is to rotate the list corners to the left until the first pair
containing a 0 in the x-position or the y-position is on the far right. The second edge
point will have naturally migrated to the head of the pack!

Figure 3: Polygonal cell for site (xc,yc)

All that is left to do now is automatize the process. In Maple, generate a procedure
which carries all steps mentioned above transparently. Here are two graphics associated
with the program involving six and twenty sites respectively.

Figure 4: Voronoi diagrams for N=6 and N=20

Conclusion

The implementation of this summer project took place over a period of eight
weeks. The overall algebraic aspect of the problem was quite manageable but the
algorithmic and computer implementation were much more demanding with the
author finally assembling everything as undergraduate students lack exposure to
algorithmic computing when mathematics is driving the programming. While students
may have felt at times that the situation was overwhelming, it was nevertheless an
excellent experience that made them appreciate all aspects of the research, including the
difficulty of reaching the objective and the wonder that many parts of their
mathematical knowledge ultimately came to play in a completely unpredictable way.
Bibliography


Speculation about what motivated his decision has concerned scholars since at least that same month. Some historians have suggested the destruction of the Maine battleship in the Havana Harbor on February 15, 1898, led directly to war and was the chief factor in McKinley’s decision for war. For example, Senator Redfield Proctor, in 1898, was convinced of the need for American intervention to solve tensions between Cuba and Spain. Proctor’s March 17, 1898, report to the Senate about his visit to Cuba confirmed reports of inhumane treatment of Cubans by Spanish General Valeriano Weyler. Another senator, Shelby M. Cullom, reportedly said war might have been averted had the Maine not been destroyed in Havana’s harbor. Even though Congressional representatives were suggesting war because of the Maine incident and poor treatment of Cubans by the Spanish, McKinley still did not declare war for well over two months after the Maine’s destruction. What delayed his decision for so long? After all, American soldiers had been killed in the Maine explosion; Americans living in Cuba had been included in the garrison-like reconcentrados, or detention camps; the “yellow press” and
Congress were calling for war. This paper attributes McKinley’s delay in declaring war as related to a dignified elitist attitude of many Americans in 1898. As well, many letters from private citizens to McKinley supported the President’s policy of peaceful negotiations. These two important potential influences encouraged McKinley to continue his peaceful approach towards the Spanish and Cuban situation.

Professor Louis Perez declares that some historians suggest public opinion, in combination with the destruction of the Maine, forced President McKinley to declare war. Perez also believes that public opinion’s influence on McKinley’s decision to fight rests on a larger belief system-- what a nation thinks itself to be and specifically the way a people arrange the terms by which they choose to represent themselves.

An American attitude of superiority during the late 1800s has been noted by many authors. Private letters to McKinley also reflect the elitist attitudes prevalent at a time when McKinley had to decide whether or not to involve the country in a foreign war that would result in America being labeled an imperialist power. Clearly, as stated in his December 6, 1897, Message to Congress, President McKinley’s preference was to avoid a war at all costs. His reason for delay in deciding for war is found in Americans’ perception of themselves and in the counsel of private citizens urging him to stay the peaceful diplomatic course.

On March 28, 1898, weeks and weeks after the explosion of the Maine, McKinley sent a special message to Congress making reference to the ultimate calm and reason exhibited by Americans. He claims that such calmness and reason could not have been
forthcoming in a community less just and self-controlled than Americans who waited patiently for results of an official government investigation of the explosion.\textsuperscript{11} Many surviving letters indicated support for peaceful diplomacy towards Spain.\textsuperscript{12} Americans told McKinley how he should formulate American foreign policy with Spain. Most citizens wrote that a more dignified and statesmanship-like response to Spain was preferable. An image of Americans as thoughtful and reflective versus passionate and uncontrolled warmongers was part of recommendations to the President about the Cuban question.

This paper will suggest that McKinley read those letters, or was made aware of their content by his secretaries, and heeded the advice and opinions expressed in the letters. McKinley’s ability to avoid war for as long as he did suggested a courageous and principled leadership.\textsuperscript{13}

\textit{A Decision to Delay War}

From the day he took office, McKinley indicated his intent for a peaceful resolution of the Cuban crisis.\textsuperscript{14} He reported that the American minister to Spain was directed to impress upon the Spanish government America’s wish to lend aid “toward the ending of war in Cuba” through a “peaceful and lasting result.”\textsuperscript{15}

The attitude of Americans throughout the 1800s may have colored the President’s decision about war against a foreign country. Some Americans believed that their Christian faith and Anglo-Saxon heritage made them the most intelligent people in the world.\textsuperscript{16} In his First Inaugural address, March 4, 1897, McKinley stated that, “Our
faith teaches that there is no safer reliance than upon the God of our fathers, who has so
singularly favored the American people in every national trial…” Some Americans
believed they were the most politically-astute nation in the world, capable of helping
lower-level races such as the Cubans and the Spanish improve governance. They
believed in the independence of Cuba and saw themselves as the island’s benefactors.17

Charles Darwin’s theory of natural selection, “The survival of the fittest,” was
used by some intellectuals in the 1800s to support the superior attitude of the American
Anglo-Saxons. The growth in numbers of Anglo-Saxons and their superior belief in the
color character of their institutions appeared to support Darwin’s theory. Further evidence to
support that belief is offered by President McKinley in his March 1897 inaugural
address.

McKinley stated that naturalization and immigration laws should promote a
“better and higher citizenship” thereby avoiding what McKinley termed a “grave peril
to the Republic” by those “too ignorant to understand” American institutions and laws.
McKinley even suggested that the naturalization and immigration laws should be
improved to promote a higher level of citizenship for those who wanted to become
Americans. McKinley added, “Illiteracy must be banished from the land if we shall
attain that high destiny as the foremost of the enlightened nations of the world which,
under Providence, we ought to achieve.”18 Those words carried a lot of meaning for
American citizens in the 1800s. Historian Louis Gould analyzed McKinley’s beliefs
regarding Grover Cleveland’s 1895 comments challenging Great Britain on the Monroe
Doctrine. He wrote that McKinley told reporters that Cleveland’s words were very much American in letter and spirit and that the calm and dispassionate manner of Cleveland upheld the honor of the Nation and insured America’s security. The theme of American spirit and honor spoke to the national feelings of dignity and superiority.

John Fiske, American philosopher and historian, wrote an 1885 essay entitled, “Manifest Destiny.” That essay potentially provided intellectual support to the American public’s belief in their superiority. Early in his writing career Fiske attempted to reconcile orthodox religious beliefs with science. He wrote that eventually four-fifths of the human race would soon trace its pedigree to English forefathers just as four-fifths of white people of the United States could do in the 1800s. Representations of 1898 were early invested with the ideals by which Americans wished to define and differentiate their place in the international system.

Geo-political expansion had been kept in check throughout the 1800s in the form of political adherence to the Monroe Doctrine. That doctrine put forth by President James Monroe in 1823 supported the independent nations of the Western Hemisphere against European interference. The doctrine, in essence, kept nations within the Western Hemisphere from creating new colonies and expanding their territorial boundaries. America promised to abide by the Monroe Doctrine as well. Having been a congressman and governor, President McKinley was keenly aware of the Monroe Doctrine: “America cherishes the policy of non-interference with affairs of foreign governments ... content to leave them to settle their own domestic concerns.”
McKinley favored an American policy of non-interference in other countries’ domestic problems. McKinley refers to the 1895 treaty of arbitration between the United States and Great Britain over Venezuela as an example of what he refers to as adjustment of difficulties by judicial methods rather than force of arms. McKinley was suggesting that the “keep the peace” treaty helped to advance civilization and represented reason and peace over passion and war.

McKinley may have symbolically recalled the awful reality of his civil war days as a younger man. Gerald Linderman writes that the Civil War overtook McKinley at the threshold of his manhood. “Experience joined temperament in commissioning McKinley to protect and nurture America’s reestablished, but very fragile, unity for what he called “American values....” Linderman adds that McKinley was determined to build stronger social beliefs using the values he, too, cherished as a theme of his administration. The memory of how war destroys social unity is suggested by Linderman as a deterrent to war for McKinley, thereby, erecting his personal opposition to war.

McKinley’s profound Christian faith would point him in the direction against war. Throughout the 1800s the teachings of Christianity were prevalent among the Anglo-Saxons. Respectable whites practiced Christian beliefs and taught those beliefs to their slaves and others they felt were not part of their Christian lifestyle. For McKinley, God was a daily reality, a benevolent and very personal deity who guided the lives of his people. In practice, McKinley was confident of his ability to discern God’s intent and
to act so as to remove obstacles from God’s path. Linderman wrote about McKinley’s remarks to an Atlanta audience. “At peace with all the world and with one another, what can stand in the pathway of our progress and prosperity?” Peace, progress, prosperity, and Americans as the “fittest” of men on earth offers a possible explanation of the President’s preference for the high ideals of diplomatic negotiations over war between March 1897 and before April 25, 1898, the day war was declared.

Public opinion about political issues of the day can be difficult to document. In 1897 when McKinley was elected into the Presidency, the question of how America should deal with the insurrections in Cuba was a hotbed of discussion. McKinley asked several of his advisors to make suggestions for his March 4, 1897, inaugural speech. One of his advisors at the time, Senator John Sherman, submitted a draft copy on the Cuban issue that promised American intervention. The fact that that draft never made it into McKinley’s speech indicates McKinley’s conviction to avoid war as it related to the insurrections on the island.

McKinley made several references to the wishes of “the people.” The opening line of his inaugural speech stated, “In obedience to the will of the people.” He goes on in the speech to speak of “popular utterances,” the “people love” of free institutions, and the hearty approval of “the people” regarding government. McKinley even professed that politicians are “bound by the voice of the people” over any “expression of political platform.” That first inaugural speech defined McKinley’s focus on adhering to public opinion and the will of the people, the public, as the divining rod of his
administration. McKinley deliberately sought out public opinion, asking visitors, “What do people up your way think of it?” (“it” refers to a specific issue of the day). In fact McKinley would say to his presidential secretary, John Addison Porter, after his public receptions, “I feel better after that contact.” The presidential image portrayed by McKinley was one of a presiding officer who affirmed what he thought bound all Americans---belief in God, love of country, and confidence in progress through individual effort.28

McKinley’s December 6, 1897, message was tinged with American superior beliefs even as he referred to the policy of concentration that Spain forced upon the agricultural inhabitants of Cuba. Spain hoped by gathering Cuba’s rural populace into camps within garrison towns to cut-off assistance to the insurgents; the President termed the Spanish tactics unsuccessful. Such comments imply the primitive nature and undeveloped sensibilities of the Spanish as compared to the superior minds of Americans. In that same message McKinley must have felt confident in his diplomatic approach because it seemed as if he had secured a resolution from Spain to settle the insurrections in Cuba. He told Congress the Spanish planned to begin governing the island by an executive and a local council or chamber in an effort to appease the insurgents. Those diplomatic actions, he felt, successfully prevented the departure of a single military expedition or armed vessel from American shores. The peaceful diplomacy of his administration and response from Spain is in accordance with America’s “high sense of right....” Although Spain did not keep their promises
regarding Cuba, McKinley still maintained his peaceful diplomacy for another four months. That peaceful, anti-war approach by the President promoted the America ideals of dignity, superiority, and diplomacy over war in dealing with the question of Spain and Cuba.

*Private Letters Urge Delay*

Supposedly, McKinley received over one hundred letters per day prior to the Spanish-American War. The number of surviving letters in the McKinley collection do not appear to come anywhere close to reflecting one hundred letters per day on any day prior to the war. It is estimated that there are approximately one to four hundred surviving letters in the President’s papers. Most letters concerning the issues surrounding Spain and Cuba are dated well after the *Maine* explosion.

Letters written to President McKinley by private citizens expressing their opinions should have been important to the President. Of course, newspapers existed and were considered reports of public opinion. From President McKinley’s perspective, a letter from a private citizen may have carried more weight than a newspaper report. Several citizens wrote to McKinley expressing thoughts about some newspapers’ comments. Of the references to the newspapers, one letter writer stated, “political and sensational newspapers do not voice the sentiment of the lovers of our country.” An appellate court justice from Chicago wrote that he approved of McKinley’s policies and that, “I think we ought to say so now when there is so much senseless clamor...in some of the newspapers.” A member of the New York Press Club wrote to the President. He
suggested the President should cut out an editorial entitled, “Let us welcome debate,” from the New York Herald and place it in the hands of every senator and representative. The press club member believed the editorial could be valuable to the President in securing congressional support for his “God inspired efforts for peace.” Considering McKinley’s religious piety and desire to maintain diplomatic peace with Spain, that letter may have been important to him.49

Did those letters convince President McKinley to delay his decision to declare war? The level of importance that McKinley placed on the approval of those private letter writers would indicate that the private letter did indeed at least factor into the equation of his decision to delay war.

Many surviving letters from citizens to President McKinley just before the outbreak of the Spanish-American War discuss the issue of the Cuban rebellion and Spain’s policies. McKinley was very much aware of the importance of the letters he received. He wanted all mail to be acknowledged and all letters directed to the appropriate department.29 From March 1898 through April 1898, there are many surviving letters that include opinions about how citizens felt McKinley had been dealing with the Spanish Cuban dilemma up to that time. Those surviving letters indicate clear support of continued diplomatic negotiations by the President.30 That is significant. The destruction of the Maine incident had already occurred, and private letter writers were still commending McKinley for his patriotic and statesman-like policy with the Spanish government.
Henry Cabot Lodge in 1899 wrote that American “public feelings grew tenser every instant,” following the destruction of the Maine. Richard H. Titherington wrote that the sinking of the Maine meant war between the United States and Spain. The critics of the time denounced McKinley for his timid and half-hearted policy towards Spain following the explosion of the Maine. The surviving letters from the McKinley Papers collection do not appear to represent a “tense” public feeling about the Maine. None of the letters suggest that the sinking of the Maine meant immediate war. The letters seem to indicate great concern about maintaining peace with Spain instead of war. Did McKinley listen to the letter writers who were praising him for his peaceful diplomacy over critics who were crying for war? It appears that as of March 1898, well after the Maine exploded, the letter writers praising his peaceful diplomacy held his ear for the moment. Letters from citizens expressing their thoughts about political issues seem to have been received with considerable attention.

Letters from citizens to the President of the United States certainly offer a potentially unbiased glimpse into public thoughts related to political issues of the day. A private letter to the President’s Secretary insists: “If war can be honorably avoided surely we must not enter upon warfare...” Another correspondent noted: “every pledge has so far been fulfilled and the majestic dignity and calmness with which you have treated the Cuban and Spanish question has been commented on by every republican and almost every democrat I know.” This latter letter should have been of particular interest to the President’s secretary who knew how McKinley would query visitors
about what “people up their way” thought about a certain issue. Also the letter references the fact that the writer feels McKinley has indeed fulfilled each pledge he made to Americans at the onset of his presidency. The letter writer does not state so, but the reference could be to the promise of peace over war in the President’s March 1897 Inaugural speech.31

A correspondent from Macon, Georgia, described his “admiration and happiness for the conservative and discreet, but always elevated and resolute American policy” McKinley had “pursued in...relations with Spain and Cuba.” This letter is very clear in its adherence to the feeling of Americans in the 1800s when the writer speaks of the “elevated” American policy. The words “superior” or “dignified” or “high-mindedness” might also have represented what that writer intended. Further evidence of American superiority is presented in a letter from a young man asking to be considered for the position of U.S. Consular Agent at Bari, Italy. The applicant writes that he is better-qualified as an American-born citizen; the incumbent is an “alien” of German birth.32

A Fall River, Massachusetts, correspondent told the President “like all Americans...I am proud of you.” This letter points out an interesting theme that runs through several surviving letters. That is the confidence each writer expresses in being sure they were speaking for themselves, their friends and family, and even others in their hometowns. A Madison, Wisconsin, citizen stated, “Your action so far has met with the warm approval of the better class of people in this community, who wish that
the horrors of war may be averted.” Another citizen wrote: “Among a large number of friends with whom I have discussed these troubles I have yet to meet one who has failed to approve of your policy.” 33

It is not always clear in the letters to the President what stratum of society the author represents. Whether the private letter writer was a business person, a government representative, or someone with a financial stake in the political outcome of the Cuban dilemma was not always discernable. For example, H.H. Kohlsaat wrote to McKinley on at least seven different occasions for reasons that varied from recommendations for friends seeking jobs to advice about Spanish foreign affairs. 34 One of the first letters dated March 15, 1897, deals with Kohlsaat’s desire for a certain candidate to receive the appointment of an assistant postmaster general. That letter was written on the letterhead of the Chicago Times Herald. Mr. Kohlsaat’s second letter dated April 2, 1898, is not written on the Herald’s letterhead and states, “There is but one opinion as to the future action if Spain refuses Cuban independence there shall be no delay but action should be short, sharp and decisive. We have sustained your policy with vigor but believe the matter should be settled now.” Kohlsaat may have been speaking from a businessman’s perspective, but, with the change in letterhead, maybe he tried to hide that fact behind his private citizen status in the latter letter. Kohlsaat’s first letter suggested a strong friendship bond between Kohlsaat, his wife, and President and Mrs. McKinley. He wrote that his wife sent her love to Mrs. McKinley. The letter also stated Kohlsaat and his wife were happy to hear good reports regarding Mrs.
McKinley’s health. Kohlsaat ends the letter by stating, “In looking over this letter I see that I have used the term “Governor”. I do not use it as a political title, but as a term of affection.” Kohlsaat’s second letter appears to offer the tone of a friend still, who is suggesting that public opinion has altered in regard to the President’s peaceful diplomacy towards Spain. Kohlsaat suggested to McKinley that it is time to bring to a close the peaceful negotiations between America and Spain. His second letter represented one of a very few of the surviving letters that suggested war in the final result if Spain did not capitulate to American demands. Kohlsaat’s second letter contains a line suggesting that he too is speaking for many people when he wrote, “There is but one opinion among the conservative people here and that is that you have done everything in your power to avert war; come what may, you will have done your full duty.” Kohlsaat, who sometimes signed his letters to McKinley as “sincerely your friend,” appeared to address an issue that held some importance to the President. That is the issue of “done your duty.” As a friend, he may have known that McKinley possessed a great sense of duty and his letter was attempting to help the President allay that concern and move from his position of delaying war to at least considering war as an option.35

A Medina, New York, citizen offered the following advice: “Let government act or back down Spain will soon be fully ready to dictate to us.” Some public sentiments included suggestions of military action or war against Spain. A correspondent from
Philadelphia insisted: “The American people want the recognition of Cuban Independence by Spain or fight.”

Letters that suggested America fight Spain to secure Cuban independence represented a minority in the surviving letters. A New Yorker wrote, “If we must fight why wait. The Spanish fleet now in the West Indies and on its way there should be met and crushed before it can be united with the powerful ships still on the Spanish coast.” This letter is from a citizen who kept a close watch on issues involving Spain and Cuba.

Many letters invoke religion. McKinley even included a religious theme in his 1897 inaugural address. In that speech, President McKinley said, “Our faith teaches that there is no safer reliance than upon the God of our fathers....” He closed that address with another religious reference stating, “This is the obligation I have reverently taken before the Lord Most High.” One person from Brooklyn, New York, wrote to McKinley: “…that we are not plagued into a war for which we are not prepared but into one also which, had we allowed ourselves be swept into by the passion of war, would have been alike wicked in the sight of God....”

Organizations or members within an organization also wrote to the President to express their opinions about the President’s policies and about the Spanish American issue. Boston’s Peace Society urged McKinley: “…be true to the noblest ideals and hopes of our powerful Christian nation....” A private letter from Adams, Massachusetts, stated, “God will give you strength for the burdens of the second
year.”\textsuperscript{39} Strong Christian faith girded Americans’ understanding of their superiority over other nations of the world.\textsuperscript{40} Some forty-one members of the Faculty of Arts and Sciences at Harvard University wrote to McKinley and offered their hearty commendation and support of his efforts to maintain peace.\textsuperscript{41}

Other themes found in the letters to the President in support of his peaceful policy towards Spain and Cuba focused on patriotic spirit, wise moderation, and respect of America by the world.\textsuperscript{42} Three pastors from Washington, D. C., wrote the President in 1898 and stated they fully appreciated the great responsibility that rested upon McKinley in connection to foreign relations but that honor, safety, and American dignity must be maintained. The San Francisco Chamber of Commerce wrote to their Senator, George C. Perkins, and asked him to pass along the following message to the President that stated the policy pursued by the President was in thorough accord with “our dignity as a nation and the best interest of our Country….” Again the superior image and dignity of the country comes to the forefront in this letter. The Chamber of Commerce informed the President they had requested that the California Congressional Delegation “…sustain and uphold the President in the furtherance of the policy with which he had adopted.”\textsuperscript{43}

Letters received by the Department of the Navy commended McKinley’s “course regarding the Cuban situation.” Some letters writers were concerned about taking the President away from his important duties and wrote to others in his administration or to their congressional representatives.\textsuperscript{44}
There were many congratulatory letters within the McKinley papers. One citizen wrote to congratulate the President on his first year in office. Another wrote of great admiration for McKinley’s record during the first year of his administration. Still another writer congratulated the President on his high degree of success during his administration’s first year. McKinley’s demeanor suggested values that may have resonated with his private correspondents.

A couple of letters expressed thanks for the improved economic conditions in the country. An Arizonan offered: “Arizona feels the benefit of improved conditions in the country” since McKinley had taken office. From Los Angeles a writer expressed thoughts about the prosperity that McKinley’s administration had brought to the nation.

“You furnish the pictures, I’ll furnish the war”

McKinley’s use of the private letters he received resembles the way other president’s used letters sent to them. Robert Merton indicates that Lincoln referred to letters from citizens as “public opinion baths.” Such letters may create a conduit of communication between a self-selected part of the American people and men in high political office. So why would a politician not take the letters as serious and honest representations of public opinion? Merton claims that George Washington reportedly “expressed great apprehensions at the fermentation which seemed to be working in the mind of the public” based on the letters he received, while President. Woodrow Wilson’s close friend and biographer reported that Wilson responded enthusiastically
to the approving letters he received while in office. Wilson felt the same way when private letters indicated a strong public opinion against war.\textsuperscript{51} President Lincoln’s impressions on certain issues were based on correspondence sent directly to him. Franklin D. Roosevelt is credited for his “systematic use of mass mail during the early days of his political career...” For the earliest presidents who were far removed from the average everyday citizen, private letters were one of a couple of ways citizens could directly communicate their opinions on various political issues to public office holders. FDR’s creative use of the mail from private citizens included him urging people to write and indicate support for his policies.\textsuperscript{52} Merton felt that such a use of the mail opened the gates to the dangers of direct democracy represented by the correspondence sent to political figures from citizens.

This paper suggests that McKinley’s delay in seeking war may have been related to dignified and elitist attitudes held by Americans in 1898 as well as the private letters supporting McKinley’s peaceful offers to Spain designed to help the Spaniards deal with the Cuban rebellion. Most of the surviving letters analyzed in this paper are dated after the \textit{Maine} incident and advised the President against war. The loss of 266 American lives on the \textit{Maine} did not alter the private letter writers from maintaining their cry for continued peace between America and Spain.\textsuperscript{54} The explosion of the ship also failed to influence the President to deter from his peaceful diplomatic course for another two months. That evidence gives credence to the theory of this paper that public opinion in the form of American attitudinal beliefs and private letters to the
President factored into McKinley’s decision to delay war. McKinley may have used the private letters to support his already imbedded belief that peaceful diplomacy was the path he would take. The private letters were just confirmation of that viewpoint. If the President really wanted to go to war against Spain, the explosion of the Maine could have been used to do so. McKinley did not want the outcome of his negotiations to end in war, and the mood of the country, as reflected in the private letters, appeared to support that view.

Merton argues that if public opinion had no social consequences, public officials would take no interest in its assessment. Historian Joseph R. Strayer observed that “the opinion of the general public does not immediately control policy, but it sets limits within which the men who make policy must operate.” For certain, McKinley did not rush into declaring war in 1898, in spite of the extreme provocation of the sinking of the Maine. It seems clear that letters from private citizens urging peaceful resolution were part of the reason, and perhaps the most important reason.
Notes


12. McKinley Papers, reels 57-60.


15. Richardson, Compilation, pg. 129.


17. Perez, The War of 1898, pg. xiii.

18. McKinley Inaugural Address, March 4, 1897, Bartleby.com


22. McKinley Inaugural Address, March 4, 1897, Bartleby.com


25. McKinley Inaugural Address, March 4, 1897, Bartleby.com


27. Ibid., pg. 9-10.


30. McKinley Papers, reels 57-60.

32. Emory Speer to McKinley, March 7, 1898, reel 60; John William Quinn to McKinley, March 15, 1897, reel 58, McKinley Papers.

33. Spencer Borden to McKinley, March 7, 1898, reel 60; Henry C. Payne to McKinley, April 7, 1898, reel 60; I.A. Roosevelt to McKinley, April 4, 1898, reel 60, McKinley Papers.

34. H.H. Kohlsaat to McKinley, March 13, 1897, reel 58; March 15, 1897, reel 58; March 18, 1897, reel 58; May 15, 1897, reel 58; May 25, 1897, reel 58; November 29, 1897, reel 59 and April 2, 1898, reel 60, McKinley Papers.

35. H.H. Kohlsaat to McKinley, March 15, 1897, reel 58; April 2, 1898, reel 60, McKinley Papers.

36. W.B. Howell to McKinley, April 12, 1898, reel 60; W.H. Folwell to McKinley, April 12, 1898, reel 60, McKinley Papers.

37. Benj. F. Tracy to McKinley, April 2, 1898, reel 60, McKinley Papers.

38. Letter writer (name is illegible) to McKinley, March 6, 1898, reel 60, McKinley Papers.

39. Boston Massachusetts Peace Society to McKinley, March 28, 1898, reel 60; W.B. Plunkett, to McKinley, March 4, 1898, reel 60, McKinley Papers.


41. Harvard University Faculty of Arts and Sciences to McKinley, April 4, 1898, reel 60, McKinley Papers.

42. John S. Witcher to McKinley, April 11, 1898, reel 60; William Elkins to McKinley, April 8, 1898, reel 60; Robert J. Lowry to McKinley, April 5, 1898, reel 60, McKinley Papers.

43. Lucien Blank, C. Herbert Richardson and L.B. Wilson to McKinley, March 8, 1898, reel 60; San Francisco Chamber of Commerce to McKinley, April 5, 1898, reel 60, McKinley Papers.
44. Navy Department to McKinley, April 5, 1898, reel 60, McKinley Papers.

45. Wager Swayne to McKinley, April 12 1898, reel 60; John F. Dryden to McKinley, April 11, 1898, reel 60; Sherman S. Rogers to McKinley, April 11, 1898, reel 60, McKinley Papers.


47. George R. Davis, to McKinley, March 4, 1898, reel 60; Wm. H. Carlson to McKinley, March 4, 1898, reel 60, McKinley Papers.


49. Robert J. Lowry to McKinley, April 5th, 1898, reel 60; Justice Henry V. Freeman to McKinley, April 12, 1898, reel 60; Charles W. McMurran to McKinley, April 14, 1898, reel 60, McKinley Papers.


51. Ibid., pp. xvi.

52. Ibid., pg. xv.

53. Ibid., pg. xvi.


55. Sussmann, *Dear FDR*, pg. xix.

56. Ibid., pp. xix.
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To be submitted to the Florida A&M University 2009 Research Journal.
STORAGE TEMPERATURE EFFECT ON POSTHARVEST TEXTURE AND SHELF LIFE OF MUSCADINE GRAPES

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Abstract

Texture is an important attribute of fruit quality and has significant influence on postharvest storage shelf-life, transportability, and consumer acceptance. In order to optimize fruit quality, enhance the commercial viability, and extend the shelf-life of muscadine grapes, it is important to characterize grape fruit texture. In this research, twenty-seven commercially available and one newly released muscadine grape cultivars were examined for their texture/firmness at harvest and postharvest storage. Two different storage temperatures (24°C, room temperature and 4°C, cold storage room) were applied. The results showed that muscadine grape berries decayed twice as fast at room temperature as in a cold storage room for the first three days. In comparison with room temperature storage, cold storage room storage led to a higher percentage of berries with higher firmness/texture and longer shelf-life as indicated by fruit rot counting. Storage temperature is an important influence on fruit texture/firmness and shelf life of muscadine grapes. Most of the grapes decayed after being stored at room temperature for a week and, at 4°C, after about two weeks. The incidence of decay was also different for different cultivars.

Keywords: Grapes, shelf-life, and texture.

Introduction

In fruit production, texture is an important attribute of fruit quality, which has significant influences on consumer acceptance, shelf-life, resistance, and transportability (Morris, 1980). Texture includes all physical characteristics sensed by touch and is determined by fruit morphological and physiological characteristics, which can be
detected under an applied force, distance, and time (Letaief et al., 2008). Once optimum quality grapes are harvested, it is important to maintain this level of texture during storage and marketing (Ayed et al., 1999).

Considerable research effort has gone towards investigating fruit quality/texture on *V. vinifera* and *V. labrusca* but, until recently little was known about the fruit quality/texture of muscadine grapes (Letaief et al., 2008). Studies show that loss of fruit firmness after harvest is attributable to dissolution of the arrangement of cell-wall and middle lamella polysaccharides. Pectolytic enzymes are involved in pectin degradation and softening of the grape fruit during ripening (Seymour et al. 2002).

Muscadine (*Vitis rotundifolia* Michx.) is the most important grape fruit in the Southeastern United States including Florida. Following improvement in the living standards of people, the demand for fresh grapes, particularly the muscadine grape, is increasing because of its unique fruit quality and abundant health-promoting compounds such as ellagic acid and resveratrol (Banini et al., 2006). Unfortunately, the fruit is highly perishable and easily undergoes deterioration with a short postharvest shelf-life due to soft texture and high water content. Preservation of muscadine grapes by extended shelf-life is of great concern.

Many factors influence grape maturity and fruit quality at ripening and during postharvest storage. Postharvest storage temperature is the major limitation to maintain fruit quality and extend postharvest shelf-life for fresh marketing. The objectives of this research are to evaluate the fruit texture of commercially available Florida muscadine
grape cultivars at harvest and during postharvest storage at different storage temperatures, to determine storage temperature effects on fruit texture and shelf-life of muscadine grapes, and to provide knowledge and information for improving fruit quality and extending shelf-life in order to expand market opportunities of muscadine grapes.

**Material and Methods**

Twenty-eight muscadine grape cultivars were collected at harvest and analyzed in 2008. One full bag of berries was randomly hand-picked from the Research Vineyard of the Center for Viticulture and Small Fruit Research at Florida A&M University, Tallahassee, Florida. Each variety contained three replications arranged randomly in a block design. Five berries from each replication were randomly picked for texture analysis. Each berry was detached by cutting its pedicel and visually inspected for any skin damage. To avoid alterations on standing, the texture analysis was performed on the same day at harvest.

A Universal Testing Machine TAxT2i Texture Analyzer (Stable Micro System, Goldalming, Surrey, UK) was used to measure the firmness/texture of the berries. The acquisitions were made at 400 Hz, using Texture Expert Exceed software version 2.54 working in a Windows environment. The operative conditions are 2 mms⁻¹ test speed and 30% compression pressure. Berries were placed on a horizontal metal plate of the analyzer, with the pedicel in a horizontal plane. Five berries were used for each
replication. Sugar content and fruit rot were also recorded at harvest and during postharvest storage.
Results

The sugar content, firmness/texture analysis, and fruit rot data for the twenty-eight muscadine grape cultivars were summarized in Table 1. Data were the average of five berries and three replications three days after storage. Texture analysis data beyond three days were not presented because they were incomplete and unstable due to fruit rot. Results showed a significant difference in sugar content, and texture between the cultivars at harvest as indicated by a firmness reading under 30% compression deformation test. The cultivars ‘Janet’ and ‘Majesty’ had the highest reading of firmness. There was no direct relationship between sugar content and firmness/fruit texture as indicated by correlation analysis (data were not shown).

As time passed, muscadine grape berries decayed twice as fast at room temperature as at cold room storage. An average of 0.967 and 0.482 reductions in firmness reading were found for room temperature and cold room storage, respectively (Fig. 1). Cultivar ‘Rosa’ was the firmest (3.039) three days after stored at room temperature though texture was not the firmest at harvest. The newly released cultivar ‘Majesty’ was the firmest (4.133) stored at cold room temperature with a reduction of 0.997 (Fig. 2). Most of the grapes cultivars decayed/shrunk one week after being stored at room temperature and two weeks after being stored at 4°C. Decay potential or percentage of grapes with fruit rot varied depending upon variety. Unlike other cultivars, prolonged shelf life was observed for ‘Majesty’ two weeks after the storage at cold temperature with little/no fruit decay.
Discussion

Muscadine grape fruits are an essential part of the human diet providing vital vitamins, minerals, and other health-promoting compounds. The texture of the ripe fruit is an important determinant of the fruit quality, and it has significant influences on consumer acceptance, postharvest shelf-life, and transportability. Effective control of the fruit texture at harvest and storage is very important to deliver to the consumer the highest quality grape products and to encourage increased consumption. Currently, the industry worldwide faces significant problems relating to the control of quality and shelf life. The research data showed that the fruit texture/firmness analysis is a good indication of fruit quality at harvest, but not for storage due to fruit decay. It is critical to remember that fruit quality can only be maintained; it cannot be improved during the storage processes. Storage beyond one week at room temperature and two weeks at 4°C was not recommended since most of these muscadine grapes rotted or shrank.

Literature Cited


**Acknowledgement**

The authors thank Ms. Connie Newman of the Food Science Program at CESTA, Florida A&M University for her assistance in fruit texture analysis.
Figure Captions

Fig. 1: Fruit texture change three days after storage.

Fig. 2: Fruit texture change three days after storage for newly released cultivar ‘Majesty’.
<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Sugar</th>
<th>Firmness</th>
<th>24 °C</th>
<th>4 °C</th>
<th>24 °C</th>
<th>4 °C</th>
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<tr>
<td>Africa Queen</td>
<td>17.9</td>
<td>2.303</td>
<td>1.632</td>
<td>2.204</td>
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<td>1.615</td>
<td>1.462</td>
<td>9.38</td>
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<td>Black Beauty</td>
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<td>3.264</td>
<td>1.859</td>
<td>2.215</td>
<td>2.86</td>
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<td>Black Fry</td>
<td>15.5</td>
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<td>1.514</td>
<td>1.732</td>
<td>10.34</td>
<td>6.25</td>
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<td>Cowart</td>
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<td>1.005</td>
<td>2.551</td>
<td>25.64</td>
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<td>Darlene</td>
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<td>1.665</td>
<td>9.76</td>
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<td>Digby</td>
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<td>2.430</td>
<td>1.530</td>
<td>1.728</td>
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<td>Early Fry</td>
<td>14.0</td>
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<td>3.027</td>
<td>21.28</td>
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<td>FL Fry</td>
<td>16.8</td>
<td>2.497</td>
<td>1.933</td>
<td>1.613</td>
<td>51.61</td>
<td>5.26</td>
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<td>Ison</td>
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<td>1.344</td>
<td>19.35</td>
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<td>1.299</td>
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<td>2.04</td>
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<td>5.656</td>
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<td>3.595</td>
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<td>1.755</td>
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<td>Firmness (kg)</td>
<td>Texture</td>
<td>Moisture</td>
<td>Sucrose</td>
<td>Temperature</td>
<td>Total Sugar</td>
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<td>----------</td>
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<td>5.130</td>
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</tbody>
</table>

**Average grape fruit texture change 3 days after storage**

- **Origin**: 2.733
- **Room T**: 1.784
- **Cold T**: 2.261

Legend:
- Origin
- Room T
- Cold T

Storage
Texture analysis of 'Majesty' 3 days after storage in different temperature

- Origin: 5.13 kg
- Room T: 2.834 kg
- Cold Room: 4.133 kg

Storage temperature: Origin, Room T, Cold Room

Firmness (kg)
Moving from a Culture of Teaching to a Culture of Learning

Amos Bradford, Ph.D., Shawnta Friday-Stroud, Ph.D., and Jennifer Collins, Ph.D.

Abstract

Recently, there has been a shift in higher education from professors teaching to students learning. Accrediting bodies, funding agencies, employers, and students are compelling institutions of higher education to provide evidence that learning is occurring within their hallowed halls. For years, institutions of higher learning have focused on production of graduates at various academic levels through teaching. However, many accrediting bodies and other stakeholders are now requiring that universities and colleges prove that students have learned the skills and abilities necessary to be successful in a global environment. For example, AACSB requires that colleges and schools of business demonstrate that they have a systematic process in place to assure student learning. In order to meet these requirements, schools and colleges of business are developing Assurance of Learning programs to precipitate a shift in organizational culture from professors teaching to students learning. The Competing Values Model of Culture (Cameron & Quinn, 1988) suggests that there are two dimensions used to categorize organizational cultures: orientation and focus. A teaching culture fits into the rational culture, i.e., one that is control-oriented and focused on its external position. On the other hand, a culture of learning, which focuses on internal maintenance and has a flexible orientation, is categorized as a group culture. Based on this model and other organizational science literature, this research proposes a model to move from being a teaching oriented culture to a student learning culture.

Introduction

Currently, there is a shift taking place in management education from a teaching-centered culture to a learning-centered culture. This shift is caused by the request for accountability from management education stakeholders. Stakeholders now expect schools and colleges of business to demonstrate that their products are worth purchasing. That is, organizations want to know that the potential talent pool housed within schools and colleges of business fit their organizational needs. In addition,
accrediting bodies require that institutions of higher education demonstrate that their students are actually learning the material proffered by their institution. These factors have influenced the way institutions of higher education do business; it is no longer enough to say “We taught,” schools and colleges of business must now confirm that the students learned what was taught.

In this paper, the authors present a model that demonstrates how schools and colleges of business can make the shift from a culture built upon the notion of the “sage on the stage” to a culture that is grounded in the active learning principles. Based on Cameron and Quinn’s (1988) Competing Values Framework and the organizational change literature, this paper examines the shift from teaching to learning in the School of Business and Industry at Florida A & M University. A teaching culture fits into the rational culture, one that is control-oriented and focused on its external position. On the other hand, a culture of learning which focuses on internal maintenance and has a flexible orientation, would be categorized as a group culture.

**Teaching-Oriented Culture**

In the teaching-centered learning environment, the faculty operates from an “I taught” philosophy. In this approach, the student motivation issue is ignored. Therefore, faculty evaluate success based on their dissemination of information to the students sometimes ignoring how to motivate the students to learn, participate, and think critically. Under this approach, faculty assume that students in the class are genuinely interested in learning the content taught in the class and are awaiting the
information that will be given via the faculty. This approach ignores the needs, strengths, weaknesses, and learning styles of students while using a passive and individualistic learning environment in the classroom. This type of learning environment relies on the “sage on the stage” philosophy where students demonstrate their understanding of the material on static performance instruments.

In the traditional teaching-oriented culture, the lecture from the professor is “the centerpiece of instruction and students passively absorb pre-processed information and then regurgitate it in response to periodic multiple-choice exams.” (McCarthy & Anderson, 2000, p.279). Marton and Saljo (1976) propose that this passive style of learning only promotes surface level learning with a concentration on shallow performance measures versus the underlying principles that are important to deeper learning that can be used beyond the classroom.

Based on the Revised Bloom’s Taxonomy (Anderson & Krathwohl, 2001), the two lower order cognitive domains, Remembering and Understanding, align more with the teaching-centered environment. In some cases, faculty members may expect the students to apply some of the information, but it is not the primary focus of the teaching-centered environment. While in the learning centered environment the four higher order cognitive domains are the focus of student evaluation. In the teaching centered environment, assessment or the demonstration of student learning is captured in course grades as measured through sometimes subjective measures that solely assesses whether or not students have acquired (learned) the knowledge (information).
expected. In this environment, student learning is measured at static points in time and students are not given opportunities to revise their assignments after receiving feedback.

**Culture**

Culture is defined as “the pattern of basic assumptions which a group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration, which have worked well enough to be considered valid, and, therefore, to be taught to new members as the correct way to perceive, think, and feel (Akdere, 2007, p.235).” Therefore, the challenge for organizations contemplating culture change lies in changing something that is neither overt nor visible.

An organization’s philosophy and values are not synonymous with culture; they are however founded upon an organization’s culture and are a visible representation of the culture. If an organization wants to change the behaviors of their employees, it is typically done through espoused values and philosophy. If a school or college desires to change from a teaching-centered culture to a learning-centered culture, it will have to accomplish three tasks: 1) change the basic underlying assumptions, 2) change the espoused values, and 3) change the artifacts.

Culture change is hard (Welsh, Petrosko, & Metcalf, 2003). So, it is no wonder that transitioning to this new paradigm of a culture of learning has been in progress for nearly twenty years, and some faculty are still trying to make the transition. But, if
faculty can see that they informally assess student learning to aid them in continuously improving their courses from semester to semester, then maybe it will be easier to help them make the transition to formally assess their students’ learning using a rubric. Through teamwork, commitment, and faculty development, faculty can make the transition. This transition must be made because the culture of learning instead of teaching, the learning-centered environment, and assessment are here to stay.

Organizational Change Mechanisms

Just as in any organization, in order to bring about culture change, schools and colleges must introduce mechanisms to facilitate the desired cultural shift. Organizational culture typically reflects the prevailing management style of the organization; therefore, culture change will require that the basic underlying assumptions reflected in the prevailing management style must be changed. In order to accomplish this change, school and college administrators must first understand the current culture. This requires a review of the current way things are done so that administrators will know which direction to take the organization. Once the assessment of the current culture is complete, administrators must envision how they want the organization to look to support success. That is, if administrators desire their school or college to look like a learning-centered organization, then it must first be envisioned by the administrators. Administration is vital in the change from a teaching-orientation to a learning-centered environment. The administration determines the prevailing management style of the organization. In order to make this cultural shift,
administrators must change their view of success. This, in turn, will lead to a change in the espoused values and artifacts of the culture. The espoused values and artifacts are the mechanisms through which culture is expressed to the members of the organization. To change from a teaching-oriented culture to a learning-centered culture, the organization must ensure that its values and philosophy reward, expect, and appreciate learning.

In all organizations, including schools and colleges, reward systems reinforce the prevailing management style. Therefore, if a school or college wants to have a student-centered learning environment, then it will have to make sure that the reward system matches the desired student learning outcomes. For example, schools and colleges will have to reward faculty who participate in activities that lead to student learning. This can be accomplished through both monetary and non-monetary rewards. Schools and colleges can encourage faculty to embrace the student-centered learning approach to management education by compensating faculty who demonstrate a change in their pedagogy from just teaching the students to ensuring that students learn the desired concepts. Compensation could include: smaller classes, course release time, or actual financial bonuses. During these difficult financial times, actual monetary rewards may not be a feasible way to reward employees. Schools and colleges should make sure faculty who participate in a learning-centered environment are somehow rewarded for their efforts. In some instances, there may be a need to use negative reinforcement with those who are resistant to moving to a learning-centered culture. This can be
accomplished by not offering the same opportunities (e.g., smaller classes or reduced teaching loads) to those faculty members who are unwilling to engage in activities that support the learning-centered culture. If faculty are rewarded based on the old culture, then it will be very difficult to encourage them to embrace the change in culture.

In addition to adjusting the organizational reward system, schools and colleges will need to develop a systematic assessment process that focuses on continuous improvement at the program level, not on individual faculty members. It is very important that faculty understand that assessment of learning is a programmatic assessment and not an assessment of their teaching. This can be expressed through the development of a systematic assessment process, such as the FAMOUS approach used at Florida A & M University. The FAMOUS approach to assessment encompasses: Formulating the desired outcomes, Ascertaining the criteria for success at the program level, Measuring performance at the program level, Observing and summarizing results, Using the results for continuous improvement at the program level, and Strengthening the program. The FAMOUS approach, as well as other program level assessment processes, are important to the learning-centered culture because they inform all stakeholders about the performance of the program. Therefore, faculty is not threatened by the assessment since the focus is shifted from their teaching ability to the ability of the program to produce students who have learned certain skills during their tenure within the school or college. Hence, faculty is allowed to evaluate their
engagement of students in the learning process without the threat of their teaching performance being scrutinized in the process.

In addition to program level assessment, faculty development in a non-threatening setting establishes the idea that administrators support the idea of a student-learning oriented culture. Faculty development opportunities, such as learning-related conferences and seminars, may serve as a form of reward for those faculty members who participate in the learning-oriented culture development. Furthermore, internal learning-oriented development opportunities that are supported by administrators visibly demonstrate to faculty members that administrators value a learning-oriented culture.

Because people’s natural inclination is to resist change that will affect how they do things, it is important that employees trust one another and administrators. Trust can be developed among stakeholders in the learning-centered culture through participative decision-making activities. One way to accomplish this is by engaging faculty in the development of the assessment process. When faculty are engaged in this process it allows them to provide input into how the culture will look and will allow them to gain a better understanding of the assessment process. Research shows that when individuals are allowed to participate in major decisions they are more likely to accept the change that goes along with the decision than when they are not included in the process. This is vital in the transition from a professor teaching culture to a learning-oriented culture because faculty are important to the success of this change. Therefore,
it is important that they are included in major decisions since they will be responsible for implementing the changes in their classrooms. Furthermore, trust building is important in this transition so that faculty do not feel that assessment will be used to scrutinize their teaching ability. The more faculty work together on the development of the assessment process, the more likely they are to trust others involved in the process. Students may also not fully grasp the benefits of a student-centered learning culture; therefore, it is important that they are included in the development of the assessment process. This can be done through focus groups and surveys of students’ perception of the organizational culture.

Kim and Mauborgne (2000) coined the term Blue Ocean Strategy is their seminal book with the same title. They conducted a ten year study of strategic moves within more than thirty industries over 100 years. Blue Ocean strategy in organizational science terms is the simultaneous pursuit of differentiation and low cost. Organizations that pursue a Blue Ocean Strategy aim not to outperform the competition in their industry, but to create new market space or a blue ocean. This pursuit in turn makes the competition irrelevant. Within the hallowed halls of higher learning, faculty must embrace this notion of a blue ocean. That is, faculty must focus on their areas of expertise and research and not compete with their colleagues, but instead realize that each person plays an important role of student learning. Unnecessary competition among faculty for resources, power, or affiliation will hinder collaborative efforts necessary for a learning-oriented culture. To accomplish Blue Ocean thinking among
faculty, administrators should employ tipping point leadership. Tipping point leadership “hinges on the insight that in any organization, fundamental changes can happen quickly when the beliefs and energies of a critical mass of people create an epidemic movement toward an idea (Kim & Mauborgne, 2000, p.151).” For example, tipping point leadership focuses on the idea that change should be driven by internal cognitive mechanisms of individuals. Tipping point leadership focuses on people, acts, and activities that exercise a disproportionate influence of performance. Therefore, administrators should focus on making a shift to a learning-centered culture by taking the necessary steps to gain faculty buy-in.

It has already been established that a student-learning culture can be threatening to faculty members as well as students. Organizations which desire to change to a learning-oriented culture should use mentoring and collaborative leadership. Mentoring assists faculty and students in developing the skills and abilities necessary to be successful. In the learning-oriented culture, mentoring can be used by faculty members to engage students in the learning process. Also, it can be used by administrators to provide support to faculty participating in the assessment of the student learning process. Faculty leaders in the learning-oriented culture lead by mentoring and nurturing their followers. Faculty is concerned about the development of their students and use this as their focus in the classroom. In addition, administrators realize that faculty mentoring and collaborative leadership are necessary
for the transition to a student-learning culture and offer support to faculty to sharpen their skills without the threat of being punished.

**Learning-Centered Culture**

As previously stated, higher education has experienced a paradigm shift from a teaching-centered environment to a learning-centered environment. Assessment or learning assurance is the mechanism through which schools are required to demonstrate to the outside world that their students are in fact learning what they espouse to have taught (AACSB, 2008; SACS, 2008). Thus, the primary goal of a learning-centered environment is student learning. In this new paradigm, accrediting agencies are not concerned with how well the teacher is teaching or imparting knowledge; they are concerned with how well the students are learning or acquiring knowledge. While accrediting bodies require schools and colleges to demonstrate student learning, they look for a culture of learning within the institution. This means that schools and colleges are not focused on the requirements of accrediting bodies, but genuinely embrace a student-centered learning environment.

In the student-centered learning environment, the faculty must now determine how to motivate the students to learn, participate, and think critically regardless of the non-class related issues that students bring with them to the classroom. No longer can faculty assume that students in the class are genuinely interested in learning the content taught in the class. Faculty members need to re-tool themselves with a different set of skills and a new philosophy. They need to be able to determine the needs, strengths,
weaknesses, and learning styles of their students. Faculty need to move from a passive and individualistic learning environment to a more active and collaborative learning environment. Hence, a more active and collaborative learning environment forces students to become more participatory. It also allows students the opportunity to demonstrate their ability to apply the knowledge that they should be acquiring in the classroom.

The Revised Bloom’s Taxonomy is a model that can be used to demonstrate how the paradigm shift from the teaching-centered environment to the learning-centered environment is expected to yield greater results in the area of student-centered learning (Anderson & Krathwohl, 2001). The six (6) cognitive domains in the Revised Bloom’s Taxonomy from lower order thinking to higher order thinking are: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating (Anderson & Krathwohl, 2001). The lower two cognitive domains, Remembering and Understanding, align more with the teaching-centered environment, where the faculty member teaches and the students are expected to retain and recall the information taught. In some cases, the faculty member may expect the students to apply some of the information, but it is not the primary focus. In a learning-centered environment, the faculty member expects the students to demonstrate that not only do they understand the information, but that they can apply the information and use their critical thinking skills to apply the information in different scenarios. This requires that the students move to the higher order cognitive domains of Applying, Analyzing, Evaluating, and ultimately Creating.
In this new paradigm of a student-centered learning environment, assessment or the demonstration of student learning is key (Bloom, Madus, & Hastings, 1981). The paradigm shift calls for faculty to shift from focusing on grades to focusing on using an objective rubric that solely assesses whether or not students have acquired (learned) the knowledge (information) expected versus the grade they receive on the assignment (Huber, 1999). This is because the grade is typically a composite of demonstrated knowledge acquired and other more subjective or non-content related criteria. This is a hard concept for many faculty members to understand (Welsh, Petrosko, & Metcalf, 2003). What is even harder for most faculty members with a teaching-centered philosophy to accept is that a true student-centered learning environment suggests that students keeping working with the information until they can demonstrate that they have acquired the knowledge and they can use it. This would require that students are given the opportunity to rework assignments once they have received feedback to demonstrate they have in fact learned what it is that they were expected to learn. This paper needs a conclusion to sum up the information presented.
References


http://www.aacsb.edu/accreditation/process/documents/AACSB_STANDARDS_Revised_Jan08.pdf


Model of Culture Change: From Teaching Orientation to Learning Orientation

**Professor Teaching Oriented Culture**
- Production and achievement oriented.
- “We taught” philosophy.
- Controlled and structured.

**Organizational Change Mechanisms**
- Organizational reward system that aligns with student learning outcomes.
- Emphasis on program level assessments that include continuous improvement.
- Faculty self-assessment and development.
- Trust building through participative decision making.
- “Blue Ocean” thinking.
- Mentoring.
- Collaboration style leadership.

**Student Learning Oriented Culture**
- Team and interpersonal cohesion oriented.
- “They learned” philosophy.
- Controlled by loyalty, commitment and morale.
HIGH STAKES TEST’S INFLUENCE ON TEACHERS’ BELIEFS

Warren C. Hope, Ghazwan Lutfi, and Lantry L. Brockmeier

Abstract

High stakes testing is a centerpiece of reform efforts to improve education, increase student achievement, and hold educators accountable. High stakes testing affects teachers and influences their instructional practices. The research was conducted in the state of Florida, which has a state mandated test, the Florida Comprehensive Achievement Test (FCAT). The FCAT is used to measure student achievement in Mathematics, Reading, Writing, and Science. The Department of Education (DOE) employs student achievement scores to generate alphabetical school grades. The DOE uses these grades as an indicator of the quality of teaching and learning taking place within a school. Teachers’ responses to items on the Teacher High Stakes Test Survey provided information that enabled descriptions of teachers’ beliefs about high stakes testing and its influence in six domains: curriculum, teaching, work satisfaction, stress, accountability, and students.

Introduction

Reform has become the mantra of politicians and policy makers at all levels of government. Business leaders, community activists, schools and colleges of education, education experts, institutes, in fact, virtually everyone who perceives they have an interest in the quality of American public education demands reform. Educational America, for the past two decades has been entombed in an education reform movement. Indeed, it can be proffered that reform constitutes the history of education in this era.

The continuous refrain of reform is driven by dissatisfaction with the outcomes of education, specifically in terms of student achievement. It appears that America’s youth are leaving schools without the skills needed to participate fully in and be able to
contribute to society (Haycock, 2005). There is recognition that citizens and workers, which students will be in the future, need greater knowledge and skills to survive and succeed (Darling-Hammond, 2006). Education, however, is not just essential for the individual’s survival, it is also critical to the wellbeing of the nation. Because of schools presumed failure to equip students with the necessary level of competencies and skills, there is a belief that the United States stands to lose its preeminence in an increasingly competitive world (Wakefield, 2003).

Because of reform, the educational topography has changed and continues to undergo upheaval. Reform in the guise of new standards for instruction (Yinger, 1999), benchmarks, educator accountability, technology integration, block scheduling, adequate yearly progress, and teacher preparation, for example, are integral to the vision of excellence in American public education. At the present time, high stakes testing is the reigning champion of the reform movement. This status can be attributed to high stakes tests ability to establish accountability for teachers and schools, which was heretofore elusive (Vogler & Virtue, 2007). Gunzenhauser, too, (2003) asserted that there is a significant amount of evidence to conclude that the high-stakes testing aspect of education accountability has taken a dominant position. Responding to its ubiquity, Clarke, Haney, Madaus, Lynch and Lynch (2000), likened the preeminence of high stakes testing to a bull market.

High stakes testing shares the same characteristics as other contentious social issues. That is, it has its perceived advantages and disadvantages along with
proponents and opponents. High stakes tests seek to improve student learning and act as an accountability measure for education’s stakeholders (Gulek, 2003). High stakes testing fosters curriculum alignment with test standards and uses results to focus instruction on areas that need improvement. Perhaps the ultimate persuasion of high stakes testing is found in the capacity to measure and report student achievement. Hence, parents, policy makers, and teachers look to the test as definitive proof of student learning (Scherer, 2005). Linn (2003) challenged this perspective of high stakes tests relating that it compresses the curriculum and actually inhibits quality instruction. Grobe and McCall (2004) definitively asserted that tests offer no information to help students and teachers improve practices. High stakes testing has a polarizing effect in the educational community. Even so, its popularity and measurability provide refuge amid criticism. In a final analysis, high stakes testing is at the forefront of accountability in education and a determining factor in the definition of quality education.

It is doubtful that high stakes tests will become an endangered species anytime soon given America’s current obsession for testing (Kaback, 2006). There are several factors that account for high stakes test’s elevated status. Afflerbach (2005) offered three reasons for its popularity: a significant number of people believe that they are (a) fair, in that no student receives preferential treatment, (b) scientific, because they have been subjected to tests of reliability and validity, and (c) familiar, as the frequency of their administration has made them commonplace.
High stakes testing may, however, reach a point of diminishing returns. Invariably, innovation is accompanied by unintended consequences. High stakes testing is not an exception. What are the long term challenges presented to teachers because of high stakes testing? Will these challenges create incongruence between what teachers believe is their instructional role and what high stakes test requires of them? These are issues to consider as testing alters traditions in teaching and learning environment.

Testing has been a fixture in American public education for a long time. Today, it is used to demonstrate to the taxpaying public that their investment of dollars is used effectively to produce quality outcomes (Lederman & Burnstein, 2006). More than ever, high stakes testing is the tool of choice of many states seeking to secure the elusive quality education. As the quest for evidence that identifies quality education and student success continues, the most obvious benefit of high stakes testing becomes its ability to deliver a numerical score (Baines & Stanley, 2004), which can be indexed to an alphabet that symbolizes quality and achievement.

High stakes testing is accompanied by threat of consequences. For students test results are used to make decisions about promotion, retention, and graduation. For educators, results of high stakes tests are used to determine amounts of cash bonuses, removal, or reassignment. Public recognition as teachers at a failing school, based on test results, can be a significant emotional blow to educators’ feeling of efficacy. Thus, many stakeholders believe that high stakes testing is motivational and encourages educators and students to adopt a serious approach to teaching and learning (Lewis,
When used as a sole criterion of success, results of high stakes testing influence decisions about student promotion, retention, graduation, school funding, and compensation for educators. Other by-products of high stakes testing are that it leads to school labeling and affects community support. At the extreme of high stakes test consequences looms the possibility of school take-over by state government.

**Purpose for the Study**

Tests and testing have become economies in themselves as millions of dollars are spent each year on product and procedure. Classroom teachers are accountable for student learning, and each year the stakes reach new levels. Because high stakes testing is accompanied by the threat of consequences, pressure to perform mounts and teachers are the keys to student growth and learning (Arnold, 2006). Similarly, Vogler (2002) concluded from research that studies on the effect of high stakes tests on teachers is important and should be ongoing. This research acts upon this recommendation and seeks information about high stakes test’s influence on teachers’ beliefs in the state of Florida. In Florida, the FCAT is a key element in the state’s school improvement and accountability system. Based upon test results, schools are awarded a letter grade, A, B, C, D, or F, which is an indicator of the school’s quality of education. In addition, the test determines a student’s graduation with award of diploma or certificate of attendance. Schools also receive additional funds based upon the assigned grade as determined by test results.
High stakes tests are like any other innovation introduced into the teaching and learning environment, they create concerns and initiate a change process. For teachers, the change process initiated by a high stakes test is reflected in their teaching, evidenced in the phenomenon known as teaching to the test, a shift in student and teacher relationships (Vogler & Virtue, 2007), and deep seated instructional beliefs, teachers compromise their conceptions of what constitutes best practice (Abrams, Pedulla, & Madaus, 2003). What influence does high stakes testing have on teachers and their pedagogical beliefs and practices? Have teachers’ beliefs been altered because of high stakes testing? Are there emerging trends in teachers’ behavior as a result of high stakes testing? This research sought to quantify high stakes tests’ influence on teachers’ beliefs in six domains of (a) curriculum, (b) teaching, (c) accountability, (d) work satisfaction, (e) students, and (f) stress.

Methodology

Population and Sample

The Florida Department of Education provided statewide teacher information from the 2005-2006 Staff Information System database. A cover letter asking for permission to administer the survey to a random sample of teachers in the district and a copy of the survey were sent to all 67 school district superintendents in the five geographical reporting regions of the state. Superintendents or school district Institutional Review Boards in 22 school districts responded to our request and 20 school districts granted permission to send the Teacher High Stakes Testing Survey to their
teachers. Concern about the external validity (i.e., population validity) of the study arose due to the difference between the target population (67 school districts) and the accessible population (20 school districts). A non-significant chi-square, $\chi^2(4, N = 67) = .515, p = .972$, indicated that the 20 school districts adequately represented Florida’s five geographical reporting regions.

Three hundred seventy-five teachers were selected via random sampling and mailed a cover letter and the Teacher High Stakes Testing Survey. The cover letter included information about the research purpose, permission of the school district, confidentiality of responses, number of survey items, and average time for completion. Survey instruments were coded only to maintain a record of respondents for subsequent follow-up mailings. Of the 375 mailed surveys, 140 of 155 returned surveys were complete and usable for analysis. The response rate for the investigation was 41% after a follow-up survey was mailed to non-respondents.

Instrumentation

The Teacher High Stakes Testing Survey was employed in this study to obtain information from teachers about the influence of high stakes testing on their beliefs in six domains (curriculum, teaching, work satisfaction, stress, accountability, and students). Forty-eight items were constructed on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Survey items were constructed based upon a review of the literature that presented positive and negative attributes of high stakes testing. The Teacher High Stakes Testing Survey development process entailed the
delineation of specific domains, item construction, and content validation. An expert panel was asked to provide feedback on the domains included on the survey, items in each of the six domains, and the technical adequacy of each item. In addition, a small pilot test of the instrument was conducted.

Cronbach’s alpha reliability for the Teacher High Stakes Testing Survey was .95. The subscale Cronbach’s alpha coefficients were .70 for curriculum, .89 for teaching, .81 or work satisfaction, .88 for stress, .84 for accountability, and .47 for students. Cronbach’s alpha reliability coefficients were good to very good for 5 of 6 subscales on the Teacher High Stakes Testing Survey.

Results

Demographic Information

Table 1 presents the number and percentage of teachers responding to the Teacher High Stakes Testing Survey by gender, educational level, race or ethnicity, school location, school type, and grade level taught. Teacher High Stakes Testing Survey respondents were approximately 78% female and 22% male which matches the statewide demographics for female and male teachers. A non-significant chi-square, \( \chi^2(1, N = 165,746) = .01, p = .920 \), indicated that the proportion of female and male respondents were similar to the overall teacher population. Respondents were 90% Caucasian, 8% African American, and 3% Hispanic, whereas the statewide demographics for Caucasian, African American, Hispanic teachers were 76%, 14%, and 9%, respectively. A significant chi-square, \( \chi^2(2, N = 116,712) = 13.907, p = .001 \), indicated
that the proportion of Caucasian, African American, and Hispanic respondents differed somewhat when compared to the overall teacher population. Approximately 53% of teachers reported having a bachelor’s degree, 42% reported having a master’s degree, 2% reported having an Educational Specialist degree, and 3% of teachers reported having a doctorate. Most teachers (62%) reported being in a suburban school and almost 49% of teachers reported teaching in elementary schools.

Table 1
Demographic Information of Teachers Responding to the High Stakes Testing Survey

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</table>
Scale Analysis

Table 2 presents the descriptive statistics and correlation among the subscales of the Teachers High Stakes Testing Survey. The Pearson correlation coefficients between the subscales range from .39 to .81. The curriculum subscale correlates strongly (.81) with the teaching subscale and correlates weak to moderate (.46 - .66) with the other subscales. The teaching subscale correlates moderately to the accountability (.74) and stress (.69) subscales. There is a positive weak to moderate correlation between the teaching subscale and students (.58) and stress (.54). The rest of the subscale correlations were positive weak to moderate correlations.

Table 2

*Descriptive Statistics of Scales and Correlation Among Scales of the Teachers High Stakes Testing Survey*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum</td>
<td>19.54</td>
<td>4.78</td>
<td>10</td>
<td>36</td>
</tr>
<tr>
<td>Teaching</td>
<td>20.99</td>
<td>7.50</td>
<td>10</td>
<td>47</td>
</tr>
<tr>
<td>Work Satisfaction</td>
<td>13.03</td>
<td>4.41</td>
<td>6</td>
<td>28</td>
</tr>
<tr>
<td>Stress</td>
<td>17.55</td>
<td>6.16</td>
<td>10</td>
<td>46</td>
</tr>
<tr>
<td>Accountability</td>
<td>18.34</td>
<td>5.26</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Students</td>
<td>15.96</td>
<td>3.45</td>
<td>8</td>
<td>27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Curr</th>
<th>Tea</th>
<th>WSat</th>
<th>Stress</th>
<th>Acct</th>
<th>Stu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work Satisfaction</td>
<td>.60</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>.46</td>
<td>.54</td>
<td>.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accountability</td>
<td>.66</td>
<td>.74</td>
<td>.52</td>
<td>.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>.47</td>
<td>.58</td>
<td>.69</td>
<td>.60</td>
<td>.51</td>
<td></td>
</tr>
</tbody>
</table>

Note. *p < .0001
Curriculum (Curr), Teaching (Tea), Work Satisfaction (WSat), Accountability (ACCT), and Students (Stu).
Discussion

**Beliefs About Curriculum**

Curriculum and instruction are at the heart of the educational enterprise. The literature suggests that high stakes testing exerts a powerful influence on curricular content (Westchester Institute for Human Services Research, 2003). The Beliefs About Curriculum domain provides some insight into high stakes test’s influence on teachers. A premise of this research is that high stakes testing has an effect on teachers. Teachers have reactions to this reform and accountability measure. In Florida, the assigned school grade, which is extrapolated from a high stakes test, is used as an indicator of the quality of teaching and learning that transpires within a school. The assigned grade is also a reflection on the educators at that school. Table 3 presents the percentage of teachers responding to each item along with the descriptive statistics.

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage of Responses and Item Descriptive Statistics for the Beliefs About Curriculum Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High stakes testing has led teachers to reassess their beliefs about subject matter that is important to teach.</td>
</tr>
<tr>
<td>2</td>
<td>High stakes testing is counter to the idea of a balanced curriculum (equal attention to subjects).</td>
</tr>
<tr>
<td>3</td>
<td>Student achievement on a high stakes test accurately portrays the quality of a schools curriculum.</td>
</tr>
<tr>
<td>4</td>
<td>High stakes testing requires teachers to teach to the test.</td>
</tr>
<tr>
<td>5</td>
<td>High stakes tests items accurately reflect the content students learn through a school’s curriculum.</td>
</tr>
<tr>
<td>6</td>
<td>High stakes testing promotes certain subjects’ content over other subjects’ content.</td>
</tr>
<tr>
<td>7</td>
<td>Students’ scores on a high stakes test provide feedback for schools to improve the curriculum.</td>
</tr>
<tr>
<td>8</td>
<td>High stakes test content is aligned with a schools curriculum.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49 32 6 11 2 4.15 1.08</td>
</tr>
<tr>
<td>2</td>
<td>51 27 8 8 7 4.07 1.22</td>
</tr>
<tr>
<td>3</td>
<td>1 5 15 46 33 1.97 0.91</td>
</tr>
<tr>
<td>4</td>
<td>50 39 5 4 2 4.29 0.92</td>
</tr>
<tr>
<td>5</td>
<td>4 18 19 41 18 2.47 1.10</td>
</tr>
<tr>
<td>6</td>
<td>54 39 4 2 1 4.44 0.74</td>
</tr>
<tr>
<td>7</td>
<td>6 33 25 26 10 2.99 1.11</td>
</tr>
<tr>
<td>8</td>
<td>8 27 28 26 11 2.96 1.14</td>
</tr>
</tbody>
</table>

Note. *5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.*
Teachers’ mean score (4.15) for item 1 shows agreement with the statement high stakes testing has led teachers to reassess their beliefs about subject matter that is important to teach. Kennedy (2006) found teachers had concerns about six different things relative to their practice. One of the elements was teaching desirable content. Because high stakes tests focus on specific content, what teachers desire to teach may be excluded from a curriculum driven by a high stakes test.

Teachers’ mean score (1.97) for item 3, student achievement on a high stakes test accurately portrays the quality of education indicates their disagreement with the statement. This score indicates that teachers do not corroborate proponents’ assertion that high stakes testing is a tool that improves the quality of education. While learning outcomes have been indexed to alphabetical grades and numerical scores, teacher responses do not support a purported cause effect relationship between high stakes tests and quality education.

A signature criticism of high stakes testing is that it obliges teachers to teach to the test. It can be argued that teaching to the test is a goal of this reform measure since the curriculum and test content are aligned. The intent of item 4 was to confirm whether or not teachers held the belief that high stakes testing required teaching to the test. As can be seen in Table 3, teachers’ mean score (4.29) for item 4 provides information to conclude that teachers believe that high stakes testing requires teaching to the test. Teachers mean score for item 4 leads to an additional analysis about item 1. Teachers’ were in agreement with the statement of item 1 that high stakes testing requires
teaching to the test. It stands to reason then that teachers have reassessed their views about what is important to teach. Arnold (2006) declared that the pressure to teach the test compromises teachers’ beliefs about how and what to teach. Kabach (2006) added to the debate concluding that the climate of today’s schools treat traits like creativity and curiosity as a professional hazard.

Finally, teachers’ responses to item 6 (M=4.44), that high stakes testing promotes certain subject area content over that of other subjects shows agreement with the statement. In Florida, the FCAT focuses on Mathematics, Reading, Science, and Writing. The curriculum gamut, however, is more extensive. Linn (2003) posited that reliance on a high stakes test leads to a narrowing of the instructional focus. Stecher and Hamilton (2002) proposed that the focus on certain domains to test is done at the expense of other areas, such as history and the arts.

Beliefs About Teaching

An individual can be frustrated when not allowed to maximize potential in the organization. Ubben, Hughes, and Norris (2007) related that organizations often keep their members in an immature state. That is, an organization’s members are not allowed to maximize potential in order to become their most effective selves. Table 4 presents the percentage of teachers responding to each item along with the descriptive statistics.
Table 4
Percentage of Responses and Item Descriptive Statistics for the Beliefs About Teaching Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>5a</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 High stakes testing permits teachers to use the full range of their teaching skills.</td>
<td>4</td>
<td>6</td>
<td>9</td>
<td>45</td>
<td>36</td>
<td>1.97</td>
<td>1.04</td>
</tr>
<tr>
<td>10 High stakes testing leads to better teaching.</td>
<td>3</td>
<td>7</td>
<td>12</td>
<td>41</td>
<td>38</td>
<td>1.96</td>
<td>1.01</td>
</tr>
<tr>
<td>11 Students’ scores on a high stakes test are a valid measure of teaching.</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>32</td>
<td>55</td>
<td>1.63</td>
<td>0.86</td>
</tr>
<tr>
<td>12 Students’ scores on a high stakes test are a valid way to determine quality education.</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td>36</td>
<td>49</td>
<td>1.76</td>
<td>0.96</td>
</tr>
<tr>
<td>13 The quality of teachers’ instruction is directly related to student performance on a high stakes test.</td>
<td>2</td>
<td>14</td>
<td>11</td>
<td>33</td>
<td>40</td>
<td>2.05</td>
<td>1.12</td>
</tr>
<tr>
<td>14 High stakes testing requires preparation that diminishes time to teach other subject content.</td>
<td>44</td>
<td>41</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td>4.20</td>
<td>0.94</td>
</tr>
<tr>
<td>15 Students’ scores on a high stakes test provide information for teachers to improve their teaching.</td>
<td>4</td>
<td>25</td>
<td>29</td>
<td>25</td>
<td>17</td>
<td>2.74</td>
<td>1.12</td>
</tr>
<tr>
<td>16 High stakes testing reduces the teaching and learning process to a student’s test score.</td>
<td>33</td>
<td>36</td>
<td>15</td>
<td>12</td>
<td>4</td>
<td>3.82</td>
<td>1.13</td>
</tr>
<tr>
<td>Table 4 continued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 High stakes testing motivates teachers to improve the teaching and learning process.</td>
<td>4</td>
<td>21</td>
<td>22</td>
<td>29</td>
<td>24</td>
<td>2.51</td>
<td>1.18</td>
</tr>
<tr>
<td>18 High stakes testing has increased cooperation among teachers.</td>
<td>4</td>
<td>17</td>
<td>25</td>
<td>30</td>
<td>24</td>
<td>2.46</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Note. *5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.

In the Beliefs About Teaching domain, teachers’ mean score (1.97) indicated disagreement with item 9 that high stakes testing permits teachers to use the full range of their teaching skills. The phenomenon is referred to in the literature as the deskilling of teachers (Vogler, 2002). Constructivist learning and student-centered approaches embodied in role play, research reports, and cooperative learning are expendable as high stakes testing acts as a catalyst to move instruction away from this type of teaching and learning (Vogler & Virtue, 2007). Thus teachers’ professional growth and even morale fall casualty to a reform that arrests creativity and learned expertise.

Teachers’ mean score (1.96) for item 10 is an indictment of the instructional restriction imposed by high stakes testing. Teachers’ disagreed with the statement that
high stakes testing leads to better teaching. Grant (2000, 2001) informed that while state mandated testing influences what teachers teach, how teachers teach is not necessarily affected. In addition, teacher efforts may result in improved test-specific skills, but at the expense of other important competencies neglected in high stakes testing (Westchester Institute for Human Services Research, 2007). Hence, equating high stakes testing with better teaching is a dubious stretch.

Teachers’ mean score (2.05) for item 13 conveys a significant amount about teachers’ beliefs and high stakes testing. Teachers disagreed with the statement that the quality of teachers’ instruction is directly related to student performance on a high stakes test. Achievement results on a high stakes test is a way of holding educators responsible for student learning. Thus a connection is established between teachers’ instructional performance and student achievement. If this reductionist process was not influenced by other factors then teaching and learning could be delineated into this lowest common denominator. No doubt teachers recognize other intervening variables influence student performance and refuse to confirm this equation. Teachers’ mean score (2.05) for item 13 placed them at one end of the high stakes test spectrum and its proponents at the other. The majority of teachers did not acknowledge that the quality of their instruction is directly related to students’ performance on a high stakes test.

Teachers’ mean score (2.51) for item17, high stakes testing motivates teachers to improve the teaching and learning process is instructive. Teachers disagreed with this statement. High stakes testing with its numerical and alphabetical designations for
students and schools intend to signify a level of educational quality. Many teachers, however, do not believe that a high stakes test motivates them to improve the teaching and learning process. Evidently, motivation for improving teaching and learning reside in other factors and not in the threats associated with high stakes testing.

Work Satisfaction

School districts in many states compete for teachers. The teacher supply is not as vast as it once was because candidates are selecting other fields in which to pursue careers. From a supply, demand, and recruitment standpoint it is important to be knowledgeable of the factors that shrink the numbers entering the teaching profession, and, as important, to understand the factors within the profession that contribute to teachers departure. From within, a case can be made that high stakes testing exacerbates the teacher shortage problem. With this in mind, analyses of teachers’ responses to items in the Work Satisfaction domain are informative. Table 5 presents the percentage of teachers responding to each item along with the descriptive statistics. Teachers’ mean score (1.52) indicate disagreement with item 19, teacher morale has increased because of high stakes testing.
Table 5. Percentage of Responses and Item Descriptive Statistics for the Work Satisfaction Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>Item Description</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Teacher morale has increased because of high stakes testing.</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>27</td>
<td>63</td>
<td>1.52</td>
<td>0.83</td>
</tr>
<tr>
<td>20</td>
<td>High stakes testing diminishes the desire to teach.</td>
<td>39</td>
<td>29</td>
<td>15</td>
<td>12</td>
<td>5</td>
<td>3.85</td>
<td>1.21</td>
</tr>
<tr>
<td>21</td>
<td>Teachers leave low performing schools because of high stakes test results.</td>
<td>38</td>
<td>27</td>
<td>28</td>
<td>6</td>
<td>2</td>
<td>3.92</td>
<td>1.04</td>
</tr>
<tr>
<td>22</td>
<td>The use of high stakes testing as a single measure to determine student achievement leads teachers to leave the profession.</td>
<td>43</td>
<td>28</td>
<td>18</td>
<td>3</td>
<td>8</td>
<td>4.00</td>
<td>1.09</td>
</tr>
<tr>
<td>23</td>
<td>Teachers’ work satisfaction diminishes when the focus on high stakes test outcomes.</td>
<td>47</td>
<td>34</td>
<td>11</td>
<td>6</td>
<td>2</td>
<td>4.18</td>
<td>0.99</td>
</tr>
<tr>
<td>24</td>
<td>Teacher satisfaction increases when they have input into the development of a high stakes test.</td>
<td>14</td>
<td>38</td>
<td>33</td>
<td>9</td>
<td>4</td>
<td>3.49</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note.* 5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.

Indeed, a reported school grade of less than satisfactory can be the basis for teachers’ loss of morale. Anxiety, fear, and shame are possible reactions teachers may have in schools with low test score results and a less than satisfactory school grade.

Teachers’ mean score for item 24 (M=3.49) teacher satisfaction increases when they have input into the development of a high stakes test reflects noncommittal, Neither Agree nor Disagree. The mean scores for items 20, (M=3.85) high stakes testing diminishes the desire to teach, and 21, (M=3.92) teachers leave low performing schools because of high stakes test results should be interpreted as Agree given the magnitude of the scores. Teachers mean score (M=4.18) for item 23, teachers work satisfaction diminishes when the focus in on high stakes test outcomes indicates agreement with the statement. The literature is quite substantial in regard to high stakes tests influencing teacher practices. That influence is often viewed negatively by teachers. Results of this research indicate that teachers interpreted high stakes tests as having an adverse
influence on work satisfaction. Finally, teachers’ mean score (M=4.0) for item 22 shows agreement with the statement the use of high stakes tests as a single measure to determine student achievement leads teachers to leave the profession. It is unfortunate that educational reform in the form of high stakes testing has this influence on teachers, which in a final analysis negatively affects supply.

Stress

That teaching occupies a space near the top of occupations deemed stressful has been known for some time. Negotiating hundreds of interactions during the course of a day, being responsible for adequate and sufficient documentation of phenomenon associated with teaching, and ensuring that instructional practice fosters learning makes teaching complex work. Educational reform in its various manifestations contributes to the stress teachers experience ordinarily by requiring them to adopt new practices that affect what they do in classrooms. In this change process, teachers experience stress related to their level of confidence and ability to manipulate and implement a reform. The literature suggests that high stakes testing is yet another burden upon teachers. Table 6 presents the percentage of teachers responding to each item along with the descriptive statistics.
Table 6. Percentage of Responses and Item Descriptive Statistics for the Stress Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>5&lt;sup&gt;a&lt;/sup&gt;</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 High stakes testing leads to competition among teachers.</td>
<td>23</td>
<td>35</td>
<td>23</td>
<td>15</td>
<td>3</td>
<td>3.61</td>
<td>1.09</td>
</tr>
<tr>
<td>26 Teacher’s stress increases when their school receives a failing grade.</td>
<td>70</td>
<td>26</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4.63</td>
<td>0.68</td>
</tr>
<tr>
<td>27 Teacher’s stress increases when their school’s accountability grade declines.</td>
<td>66</td>
<td>26</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>4.55</td>
<td>0.78</td>
</tr>
<tr>
<td>28 Punitive components of high stakes testing induce teacher stress.</td>
<td>70</td>
<td>25</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4.61</td>
<td>0.71</td>
</tr>
<tr>
<td>29 Teachers experience stress in the effort to maintain their school’s accountability grade.</td>
<td>65</td>
<td>31</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4.58</td>
<td>0.67</td>
</tr>
<tr>
<td>30 Teacher’s stress increases with public advertisement of a schools high stakes test results.</td>
<td>56</td>
<td>28</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>4.34</td>
<td>0.90</td>
</tr>
<tr>
<td>31 The pressure of high stakes testing may result in teachers cheating to improve scores.</td>
<td>12</td>
<td>23</td>
<td>30</td>
<td>19</td>
<td>16</td>
<td>2.96</td>
<td>1.25</td>
</tr>
<tr>
<td>32 District supervisors’ pressure to improve high stakes test scores increases teacher stress.</td>
<td>62</td>
<td>29</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>4.49</td>
<td>0.77</td>
</tr>
<tr>
<td>33 Principals pressure to improve high stakes test scores increases teacher stress.</td>
<td>67</td>
<td>24</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>4.53</td>
<td>0.81</td>
</tr>
<tr>
<td>34 Teachers leave the profession because of stress related to high stakes testing.</td>
<td>46</td>
<td>25</td>
<td>23</td>
<td>5</td>
<td>1</td>
<td>4.11</td>
<td>0.98</td>
</tr>
</tbody>
</table>

Note. <sup>a</sup> 5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.

Domain 4, Stress had the highest number of items wherein teachers’ mean score indicated agreement with the statement. Teachers’ mean scores reflected agreement with nine of the ten items in this domain. Teachers’ mean scores for domain 4 items support assertions that high stakes tests affect teachers by adding stress to the practice. The mean score for item 25 (M=3.61), high stakes testing leads to competition among teachers, given score magnitude should be interpreted as Agree. The lone exception was item 31, (M=2.96) the pressure of high stakes testing may result in teachers cheating to improve scores. Here the magnitude of the mean should be interpreted as noncommittal, Neither Agree nor Disagree. Teachers’ mean scores for these items can be interpreted as an unwillingness to accuse colleagues of engaging in competition.
when faced with the threat of consequences from high stakes testing. It can be posited also that a neutral stance on competition among teachers is a result of a fellowship, that is, there is an embrace of collegiality to meet the demands of high stakes testing. With regard to the practice of cheating, teachers ascribe to a code of conduct that prohibits this behavior and like most professions there is a desire to support the membership.

**Accountability**

Teachers’ responses in this domain provided insight into teachers’ beliefs about high stakes testing and accountability. Table 7 presents the percentage of teachers responding to each item along with the descriptive statistics.

<table>
<thead>
<tr>
<th>Item</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 High stakes testing has increased teachers’ accountability for students’ academic performance.</td>
<td>21</td>
<td>45</td>
<td>15</td>
<td>12</td>
<td>6</td>
<td>3.64</td>
<td>1.12</td>
</tr>
<tr>
<td>36 High stakes testing has increased teachers’ awareness of accountability.</td>
<td>32</td>
<td>50</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>3.98</td>
<td>1.06</td>
</tr>
<tr>
<td>37 High stakes testing is an effective means of determining the quality of public education.</td>
<td>2</td>
<td>5</td>
<td>11</td>
<td>43</td>
<td>39</td>
<td>1.89</td>
<td>0.94</td>
</tr>
<tr>
<td>38 Students’ scores on a high stakes test are an indicator of whether schools are staffed with high quality teachers.</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>33</td>
<td>52</td>
<td>1.71</td>
<td>0.94</td>
</tr>
<tr>
<td>39 High stakes testing is a reform measure that improves the quality of education.</td>
<td>4</td>
<td>6</td>
<td>13</td>
<td>36</td>
<td>41</td>
<td>1.95</td>
<td>1.06</td>
</tr>
<tr>
<td>40 Teachers are more accountable because of high stakes testing.</td>
<td>12</td>
<td>34</td>
<td>17</td>
<td>26</td>
<td>11</td>
<td>3.09</td>
<td>1.23</td>
</tr>
<tr>
<td>41 High stakes testing creates a cooperative environment between teachers and the community.</td>
<td>3</td>
<td>7</td>
<td>24</td>
<td>39</td>
<td>28</td>
<td>2.18</td>
<td>1.01</td>
</tr>
</tbody>
</table>

*Note. 5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.*

One of the objectives of high stakes testing is to increase educators’ accountability. Given the magnitude of the mean score (3.64) for item 35, high stakes testing has increased teachers’ accountability for students’ academic performance.
should be interpreted as agreement. High stakes testing has at its foundation improving student achievement via teacher accountability. Based upon responses, teachers recognize high stakes testing as a feature of accountability and their central role in improving student achievement.

Accountability for improved educational outcomes has an effect on teachers. Teachers’ mean scores for items 37 (M=1.89), 38 (M=1.71), and 39 (M=1.95) indicated teacher disagreement with those statements. High stakes testing is an effective means of determining the quality of public education as students’ scores on a high stakes test are an indicator of whether schools are staffed with high quality teachers. High stakes testing is a reform measure that improves the quality of education. That teachers disagreed with these items discloses disconnect relative to rationales and rhetoric that support high stakes testing as a substantive element of education reform. Teachers consistently negated the purported link between high stakes testing, quality education, and teaching. Teachers resorted to a neutral stance with regard to item 40 (M=3.09) teachers are more accountable because of high stakes testing. An extrapolation from this score is that teachers have not developed a belief about whether or not high stakes testing has motivated them to be more accountable for student learning. It may also be that teachers already view themselves as accountable in the teaching and learning process.
Students

Teaching students in their preferred learning style is important for student learning with or without high stakes testing. Accountability based on high stakes testing does not recognize the vast differences students bring into schools (Lederman & Burnstein, 2007). Under high stakes testing, all students respond to the same items under similar conditions (Coalition of Essential Schools, 2007). Any classroom contains students whose learning styles vary requiring teachers to engage in pedagogy that will facilitate their learning. Accountability, represented in high stakes testing makes it necessary that all students have access to appropriate curriculum, engaging instruction, and supportive resources (Brimijoin, 2005). Neglecting to teach a student in his or her preferred learning mode is a recipe for failure because it does not present that student with the best opportunity to acquire knowledge. There is a problem with instruction that does not take into consideration how a student learns best. Previously, teachers confirmed that teaching to the test was a characteristic of high stakes testing. Table 8 presents the percentage of teachers responding to each item along with the descriptive statistics.
Table 8. Percentage of Responses and Item Descriptive Statistics for the Student Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>5 (^a)</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>High stakes testing contributes to the number of students that drop out of school.</td>
<td>32</td>
<td>33</td>
<td>23</td>
<td>8</td>
<td>4</td>
<td>3.82</td>
<td>1.09</td>
</tr>
<tr>
<td>Students’ learning styles are accounted for in high stakes testing.</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>31</td>
<td>56</td>
<td>1.64</td>
<td>0.90</td>
</tr>
<tr>
<td>High stakes testing induces anxiety in students.</td>
<td>75</td>
<td>18</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4.61</td>
<td>0.85</td>
</tr>
<tr>
<td>High stakes testing motivates students to achieve.</td>
<td>2</td>
<td>15</td>
<td>24</td>
<td>32</td>
<td>27</td>
<td>2.34</td>
<td>1.10</td>
</tr>
<tr>
<td>The pressure of high stakes testing may result in students cheating to improve scores.</td>
<td>29</td>
<td>38</td>
<td>25</td>
<td>7</td>
<td>1</td>
<td>3.89</td>
<td>0.93</td>
</tr>
<tr>
<td>Teachers are concerned about the impact of high stakes testing on minority students.</td>
<td>47</td>
<td>34</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>4.20</td>
<td>0.96</td>
</tr>
<tr>
<td>High stakes testing has changed student-teacher interactions.</td>
<td>35</td>
<td>32</td>
<td>2</td>
<td>10</td>
<td>3</td>
<td>3.86</td>
<td>1.10</td>
</tr>
</tbody>
</table>

*Note.* \(^a\) 5=Strongly Agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly Disagree.

Teachers’ mean score (1.64) indicates disagreement with item 43; students’ learning styles are accounted for in high stakes testing. Teachers appear to recognize a difference in pedagogy required for teaching for success on a high stakes test and that which acknowledges the various learning styles of students. According to teachers, there is incongruence in teaching for high stakes test success and teaching students in their preferred learning style. Not only are modalities of learning a concern, but it must also be acknowledged that students mature at different rates. No two students are alike.

If indeed high stakes tests seek to improve education, teaching, and learning, then consideration must be given to differences in learning styles and cognitive maturity. At the moment, high stakes test drives curriculum and instruction. At the appointed grade level and specified time of year the FCAT is administered. All students are held accountable for their achievement even though many attend schools located in low socioeconomic neighborhoods, have fewer resources that can be applied to the learning environment, and lack highly qualified teachers.
Teachers’ mean score (2.34) indicates disagreement with item 45 high stakes testing motivates students to achieve. In general, students can be classified into two groups, intrinsically or extrinsically motivated. It is apparent that teachers do not view high stakes test as motivational in either designation. Teachers’ mean score (4.61) shows agreement with item 44 high stakes testing induces anxiety in students. The score gives yet another perspective on how teachers perceive high stakes testing. Anxiety does not rank high as motivational factor. Rather anxiety has the capacity to paralyze into inaction even when stakes are high. Teachers appear to realize that students confront differently the single criterion that has a significant influence in their lives, noting that it may or may not be motivational.

Among the purposes for high stakes tests is to raise the bar for teaching and student achievement. Teachers and students are expected to meet the challenge. However, there is concern that high stakes testing increases the number of students adversely affected by the test because they do not perform at a specified achievement level. The drop-out rates in states with high stakes tests continues to be a major concern of educators and other stakeholders. Motivating students to achieve by raising the bar through high stakes testing can stand to be reexamined.

Teachers’ mean score (4.20) for item 47 indicate that teachers are concerned about the affect of high stakes testing on minority students. This concern expressed by teachers can also be found in the literature. The achievement gap between minority and majority students continues to be problematic. High stakes testing has not assisted in
diminishing the gap. Dropping out of school and retention in grade are consequences that are associated with high stakes testing. While it is admirable to seek educational improvement and increase student achievement, when a segment of the population that is supposed to benefit from the reform remains disadvantaged by it, there is reason to reexamine and reevaluate its purpose and the impact it is having.

Conclusion

While high stakes testing enjoys considerable support at the policy making levels, it is at the place of implementation that unanticipated consequences are revealed. Results of this research provide a basis to make some conclusion statements about high stakes testing. One, high stakes testing influences teachers’ beliefs and practices. Two, teachers do not accept assertions that high stakes testing leads to improving the quality of education or better teaching. Three, the composite of teachers’ responses reveals a negative perception of high stakes testing. Four, high stakes testing has a negative effect on the teaching profession, particularly with regard to work satisfaction and stress.

The promise of improved education through high stakes testing is not a sentiment shared by all teachers who implement it as a reform. Moreover, teachers’ responses support the criticism leveled at high stakes testing found in the literature. Reforms, no matter the ballyhoo associated with them, often do not rise to the level of panacea or Holy Grail. There are limitations to what they can accomplish. This can be applied to high stakes testing also. High stakes tests need to be delineated into what they can and cannot do. Teaching and learning is too complex an enterprise to be
measured by a test and then reduced to a letter or number that symbolizes quality education.

There is hardly disagreement that testing has a place in the educational enterprise. There are few today who will disavow the need to measure outcomes associated with teaching in the classroom and to hold licensed professionals accountable. Concomitantly, there is need for awareness that no single measure can accurately reflect what a student knows. Today, the prominence of high stakes testing casts it in the role of sole voice with the last word about student achievement and quality education.
References


Application of Ant Colony Optimization to Optimal Foraging Theory: Comparison of Simulation and Field Results

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Abstract

Ant Colony Optimization (ACO) refers to a family of algorithms inspired by the behavior of real ants and used to solve combinatorial problems such as the Traveling Salesman Problem (TSP). Optimal foraging theory (OFT) is an evolutionary principle wherein foraging organisms or insect parasites seek to derive optimal use of time in consuming prey or parasitizing hosts. Here the researchers employ computational techniques borrowed from ACO to study optimal foraging behavior, using the red imported fire ant (Solenopsis invicta) in field experiments. The ACO-OFT algorithm models the selection of paths leading to food resources of varying amounts and varying distances to a central colony. Distances, amounts of food, and ant pheromone are determinants in selecting one path among multiple options. As such, ACO-OFT is both multiple objective (minimize distance, maximize food) and dynamic (food is diminishing). Simulations produced expected results, such as preferences for closer or higher quality food resources. Field data often did not conform to predictions of OFT, possibly because of uncontrolled environmental factors. The ACO-OFT algorithm may be improved in the path selection subroutine. For example, more realistic simulations may result from increasing the effect of pheromones, especially early in the run because of the reinforcing effect on path selection.

Introduction

Ant Colony Optimization (ACO) refers to computer optimization techniques inspired by the behavior of real ants (Dorigo and Stützle 2004). A colony of ants

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foraging for food will usually traverse the shortest distance to the food source and back, even when obstacles are introduced in its path. Although individual ants possess limited capabilities, including very poor vision, the colony displays collective intelligence mediated by their pheromones. Individual ants tend to select paths with highest pheromone concentrations. The shortest paths tend to be the most heavily-traversed because ants are able to arrive at their destinations and return more quickly. Individual ants continuously deposit pheromone, thereby increasing the probability that future foraging ants will also select heavily-traversed paths. The process is autocatalytic (i.e., positive feedback). Furthermore, pheromone evaporation on the less traveled longer paths decreases the probabilities they will be selected in the future. Although ants acting individually would probably select sub-optimal (longer) paths, the cooperative behavior of the colony, mediated by pheromones, results in optimal path selection.

Dorigo (1992) developed the concept of artificial ants to solve the Traveling Salesman Problem (TSP). TSP is a classic problem in computer science where, given a number of cities of known distances to each other, a salesman must find the shortest path where each city is visited once before returning to the starting city. Like real ants, Dorigo’s artificial ants had limited local perception. They deposited artificial pheromone on paths they traversed and preferentially selected paths with the highest levels of pheromone. Artificial ant programs found solutions to TSP problems comparable to those produced by specialized computer algorithms (Dorigo and Stützle
ACO techniques were applied successfully to a variety of theoretical problems related to routing (Bullnheimer et al. 1999); telecommunications (Sim and Sun 2003), assignment (Stützle and Dorigo 1999), scheduling (Colomi et al. 1994), machine learning (Dorigo and Stützle 2004), industrial processes (Xiao et al. 2004) and even military applications (Svenson and Sidenbladh 2003). Real world practical applications are in vehicle routing, management and optimization of heating oil distribution, and planning and simulation of industrial pipe production (AntOptima, Lugano, Switzerland).

Optimal Foraging Theory (OFT) was first proposed by Emlen (1966) and MacArthur and Pianka (1966) who argued that the importance of successful foraging to individual survival allowed the prediction of optimal behavior through the application of decision rules. An optimal forager with perfect knowledge of its prey environment should be able to maximize food intake per unit of foraging time. The fundamental assumption of optimal foraging theory is that every animal is expected to maximize its energy intake per unit of time. Inevitable departures from optimality become useful in identifying constraints in behavior or the environment. Different variants of OFT emphasized different aspects of foraging behavior (Stephens and Krebs. 1986). In the case of ants, the appropriate variant is Central Place Foraging, wherein a forager must return to a particular place in order to consume its food, or, perhaps, to hoard or feed it to a mate or offspring. With increased distance from its nest or territory, a central-forager incurs increased costs associated with travel, prey transport (Shultz and Noe
and possible risks such as predators (Chase 1998). Optimal behavior entails increased foraging efforts nearer the central refuge.

Therefore, both ACO and OFT seek to understand and predict the behavior of an animal optimizing the use of time and energy in the procurement of food. In this paper, the authors use computer techniques of ACO to simulate the behavior of ants foraging for food of different quantities and placed at different distances from a central colony. The paper compares model predictions with observed field data and attempts to define decision rules employed when selecting sources of food.

**Model description**

The computer simulation model was implemented using MATLAB 7 (The MathWorks Inc., Natick, MA). Each path to and from a food source may be conceived as an array of cells, each holding at most a single ant. For \( n \) cells in the array, the path back to the colony begins at \( n/2 \). At each time \( t \) in the iteration, the maximum number of ants on a path is therefore bounded by \( n \). The model was implemented using an array of structures of type `ant`, one array for each path to a food source. Each structure contained a field `age`, and a `direction`, ‘F’ for forward ants (i.e. going to the food source), ‘B’ for backward ants (returning to the colony). The maximum number of ants is fixed by the size of the ant arrays. During the dispersal phase of the simulation (equal to maximum number of ants), a single ant leaves the colony at each time step by selecting a path to a food source and back.
Path selection is determined by calculating the heuristic value of alternate paths. Three factors determine heuristic value: a) distance of food source, b) amount of pheromone on the path, and c) amount of food at the food source. Increasing distance of food from the colony decreases attractiveness of the path. These values are constant for each food source. Pheromone levels increase attractiveness of a path. In the original ACO model, pheromone is subject to an evaporation rate and often is deposited at levels inversely proportional to the length of the arc to an adjacent node. In the current model, a specific ant is committed to a given series of arcs to a food source after it has made its initial path selection. Therefore, the model uses a simplified pheromone equation where levels are set to the number of ants on a path. The amount of the food source is positively correlated to path attractiveness. The effect of food source is multiplicative, so that a zero food source results in 0 heuristic value for the path. Formally,

\[ h(p) = F \left( \sum_{i=1}^{n} \text{ants}(p) \right) + D \]

where \( P \) is the path at time \( t \) and \( D \) is the effect of distance (higher at closer distances). In ACO models, distance is the Euclidean value of adjacent nodes. In the current model, distances to given food sources are constants. The summation counts the number of ants on the path at time \( t \). \( F \) is the food source multiplier, which is decreased by 1 for each ant reaching the food source at node \( n/2 \). After the heuristic values of alternate paths have been calculated, the foraging ant makes its selection using the
Roulette Wheel algorithm (Holland 1975). When an ant has chosen a path, the array of
ant structures is updated by setting \( \text{ant}(i).\text{age} \leftarrow 1 \) and \( \text{ant}(i).\text{direction} \leftarrow 'F' \) where \( i \) is the
iteration time step. At each time step, ant arrays are aged by setting \( \text{ant}(i).\text{age} \leftarrow \text{ant}(i).\text{age} + 1 \). When \( \text{ant}(i).\text{age} = n/2 \), \( \text{ant}(i).\text{direction} \leftarrow 'B' \), i.e. the ant is returning to the
colony. The number of ants on each path is calculated by summing each ant array
where \( \text{ant}(i).\text{age} > 0 \). When \( \text{ant}(i).\text{age} > n \) (i.e., the ant has returned to the colony),
\( \text{ant}(i).\text{age} \leftarrow 0 \) and the ant is no longer tallied when ant counts are calculated.

**Simulation Results: Base cases**

a. **Two paths of equal heuristic value:** Baseline simulation runs were performed
using the following conditions and parameter values: two paths of equal heuristic
value; maximum ant age = 20 (corresponding to a path of length 10 to the food source,
and 10 back to the colony), no more than 20 ants would be counted on each path;
maximum number of ants = 25 (1 ant was added to the system for the initial 25 time
steps; simulation was continued for another 50 steps afterwards. The simulation was
run 50 times; results are shown in Fig. 2A. As expected, equal heuristic values of two
paths resulted in identical probabilities of selection and similar plots of ant count as a
function of time. Ant counts in both paths continue to rise until time 25 when no more
ants are added to the system. As ants return, the numbers decline to 0.

b. **Two paths, unequal distance of food source:** Same parameter values as above,
except the food source on the left is twice the distance to the colony as the source on the
right, i.e. \( h(\text{left}) = 50, h(\text{right}) = 100 \). The simulation was repeated 50 times. Results show
the expected result of a peak in ant numbers at $t = 25$, followed by a decline and a lower peak for the left path (Fig.1B).

c. Two paths, declining food on right path: Using the same parameter values as above, simulations were run where the heuristic value of the right path declined from 50 to 0. Each figure shows the rise of ant counts to $t = 25$, and the subsequent decline. The effect of decreasing attractiveness of the right path is reflected in the higher peaks of the left path (Fig. 2A) and the opposite effect on the right path (Fig. 2B). As food declines to zero, fewer ants are shown to select this path. Linear increases to the amount of pheromone on a path produce the expected increase in ant numbers and are not shown.

Comparison of model predictions and field data

Field experiments of increasing complexity were performed to compare the results of model predictions against field observations. Experiments were conducted during mid-mornings at the Center for Viticultural Sciences & Small Fruit Research, Florida A&M University, Tallahassee, Florida, United States ($30^\circ$ 23' N, $84^\circ$ 22' W) from summer to fall of 2005. For each experiment, an ant colony was selected (15 – 30 cm diameter), and food sources consisting of crackers or cookies of known weights were placed at varying distances or varying quantities. Ant foraging was recorded by visual inspection. At 5-min intervals, the numbers of ants on each path was counted. Counts were continued until at least one food source was consumed completely. Replicates with zero ant observations were discarded. After each experiment, individuals were
brought to the laboratory for identification. All ants were identified as red imported fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae).

**Experiment 1: Two sources (Equal food; Equal distances).** Because amounts of food and distances to food sources were equal, both paths had equal heuristic value (results not shown). Path selection with time will be most influenced by the amount of pheromone on the paths, especially early in the process. Field results show that it is common for ants to select a single food source. Simulations were run using the following parameter values: maximum ant age = 20; food= 100; distance = 50. Simulations showed food supplies were exploited equally. These initial simulation runs suggest that the effect of pheromone may be underestimated using the current model. When the effect of pheromone is increased 100-fold, ants select a single food source (not shown), as typically happened in the field experiments.

**Experiment 2: Two sources (Equal food; Unequal distances).** When food sources have the same approximate value, but one food source is farther from the colony, OFT predicts that the animal first exploits the closer food source. Field results did not produce strong evidence of this prediction (results not shown). Simulation runs were performed using identical parameter values as above, but the right food source is twice as far away from the colony as the left. Typical results show that ants are predictably attracted first to the closer food source depleting it at a faster rate (results not shown).

**Experiment 3: Two sources (Unequal food; Equal distances).** When distances are equal, OFT predicts the greater food supply will be exploited first. Field results
generally seem to support this prediction (Fig. 3). Simulations also show this effect; a
typical result is shown in Fig. 4 where food supply on the left path is 5x that on the
right. Food supply declines faster at the more attractive food supply.

Experiment 4: Three sources (Different food; Equal distances). Because distances to
food sources are equal, the authors expected the food sources to be visited in order of
decreasing food amount. Unlike the previous experiment, field data did not show a
strong tendency to support this prediction, with possible trends to do so in Replicates B
and E (results not shown). Simulations showed the expected result, with ants going
preferentially to the higher quantity food sources (not shown).

Experiment 5: Three sources (Equal food; Different distances). As in Expt. 2, the
authors expected closer food sources to be exploited before those farther from the ant
colony when food supplies are equal. Field data did not support this prediction (Fig. 5).
Simulations were performed where food supply was equal for three food sources, but
distances were increased by 3x and 5x for different food sources. Simulations showed
the expected preference for exploiting closer food supplies (Fig. 6).

Discussion

Both ACO and OFT are optimization theories with well documented biological
mechanisms. One important difference between ACO and this implementation of OFT
is in the selection of nodes. In ACO, an ant can select from a number of unvisited nodes.
In this implementation, the ant is committed to occupying the nodes on a specific path
and food supply once it leaves the colony. The calculation of heuristic values is
therefore critical because there are no further iterations towards an optimal solution. As in most simulations based on biological experiments, estimation of model parameters is problematic. The problem is compounded in this OFT model because of the need to place relative weights on several factors: distance to food supply, effects of pheromones, and effects of food quantity. The model needs further refinement in the critical area of calculating the heuristic values of several factors that often work in opposition. Clearly, modeling the effect of pheromone as a summation of numbers of ants is too simple. Increasing the effects of pheromone, especially that produced by early ants reduces randomness in path choice, as often displayed by real ants. Another possible improvement may be to have pheromone intensity correlate to food quality, which has been shown in a real ant study.

OFT predicts that foraging animals will maximize time or energy spent foraging by preferentially exploiting prey or prey sources that will provide the highest returns on investments. Only when these high-value sources are depleted will less rewarding sites be exploited. Field data on foraging ants did not provide strong evidence to support these predictions. Results were inconsistent, or trends were non-existent. These results highlight the difficulties in attempting to collect animal behavior or movement data in the field, outside a controlled laboratory environment. Perhaps better data might be collected using laboratory colonies with clearly defined paths to alternate food sources. In contrast, the simulations were in general agreement with theoretical
predictions, which is expected because the choice function clearly skews probabilities in favor of higher food sources or closer distances to the food.

Dorigo and Stutzle (2004) identified three types of problems for future ACO research: 1) *Dynamic problems* – where data, decision parameters and constraints may change during problem solution; 2) *Stochastic problems* – in which data, decision parameters and constraints have associated probabilities due to uncertainty; and, 3) *Multiple objective problems* – where more than one criterium are used to evaluate solutions: Most research has addressed problems wherein a single objective function is maximized or minimized. The model presented is a very early and simple attempt to use ACO techniques to study the evolutionary concepts of OFT. The authors believe that despite its simplicity, it captures elements of a dynamic and multiple objective model. The model is dynamic in that the food sources are being depleted by the ants. Therefore, an optimal choice at one point in time may no longer be best at a later time. The model is also multiple-objective in that ants seek a compromise solution between food sources that are highest in quality with those that are closest to the colony. Clearly the simple model presented has much room for improvement. The heuristic function is a gross oversimplification of biological reality. The assumption of linear paths to and from the food sources is unrealistic. Barriers to food sources often require finding alternate paths. In such scenarios, paths may be represented as nodes on a graph and shortest path algorithms may again be used as in ACO models. Related areas of research may involve cooperative transport of food, wherein an individual attempts to
realign food items to facilitate transport, or solicits assistance from others. The experimental scenarios employed in the field and tested in simulations have known optimal solutions. More complex experiments can be designed using combinations of distance and food supply that will not have solutions that are readily apparent. Hopefully, the approach will be considered useful in studying OFT and possibly other evolutionary concepts. Outside the field of theoretical biology, more sophisticated computer methods may be developed for engineering applications.

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Literature Cited


Figure Captions

Fig. 1. Base case simulations (results of 50 runs) A) Equal heuristic values for both paths; B). Path on left is 2x distance to food supply.

Fig. 2. Effect of declining food supply on path to right of colony A) Ant counts on left path as function of time and declining food quantity on other path; B) Ant counts on right path as function of time and declining food quantity.

Fig. 3. Field data for Experiment 3 (Two sources – Unequal food, Equal distances). A) Food consisted of cookies weighting 0.0455 and 0.136 g at distances of 12 cm. For replicates B – E, food consisted of cookies weighing 0.03 and 0.09 g at equal distances of 4, 7, 5 and 7 cm within each replicate.

Fig. 4. Simulation for Experiment 3 (Two sources – Unequal food, Equal distances). One food supply is 5x the other and is depleted at a faster rate.

Fig. 5. Field data for Experiment 5 (Three sources – Equal food; Unequal distances). In all replicates, food consisted of 0.045 g of cookies placed at distances of about 7.6, 15.2 and 30.5 cm from the ant colony.

Fig. 6. Simulation for Experiment 5 (Three sources – Equal food; Unequal distances). Distances increased from 1x, to 3x and 5x.
Case 1: Equal heuristic values

Case 2: Left distance 2x Right
Fig. 2

Decreasing food on Right
Left path

Decreasing food on Right
Right path

Time
Fig. 3

Graph A: Graph showing the number of ants over time for different food conditions. The graph compares the number of ants with less food (solid line) and more food (dashed line).

Graph B: Similar to Graph A, but with a different dataset.

Graph C: Another comparison of number of ants with different food conditions.

Graph D: Graph showing the number of ants over time for a different experiment.

Graph E: Similar to Graph D, but with a different dataset.

The x-axis represents time in minutes, ranging from 0 to 50. The y-axis represents the number of ants, ranging from 5 to 40.
Fig. 4

Experiment 3

- Food = 500
- Food = 100

Ant count

0 20 40 60 80

Food

0 5 10 15 20 25 30

X Data

0 85 90 95 100 105 480 485 490 495 500

500

495
490
485
480
475
470
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185
180
175
170
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
90
85

500

X Data
Fig. 5
Fig. 6

Experiment 5

- Distance = 1x
- Distance = 2x
- Distance = 3x

Time

Distance

0 20 40 60 80
0 2 4 6 8 10 12 14 16

Distance = 1x
Distance = 2x
Distance = 3x
College Level-Premium of Black Men: Is it worth Investing In Additional Levels of College?

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Abstract

Since the celebrated works of Carter G. Woodson (1933), human capital theorists have argued that despite virulent discrimination, black men will improve their labor market chances by increasing their post-secondary education level and the quality of that education. This paper presents a return to an educational-investment model that examines whether black men who pursue additional academic levels beyond high school reduce their unemployment risks and earnings inequality relative to their white cohort. As would be expected, earnings increased as levels of education rise, but relative earnings and returns are no different for black men no matter their level of education. At all levels of attained academic levels, black men earn roughly eighty cents for each dollar earned by white men; the same as if they never pursued a college degree. Further findings show that within-race returns to education exceed internal rates of return; therefore, investing in college education makes sense. However, cross-racial returns to education of black men are significantly lower than for their white counterpart for all attained education levels.

JEL Keywords: College Premium, Returns to Education, Human capital investment

Introduction

During the 1980s, racial and gender earnings inequality rose dramatically among the most educated workers, but dropped for the least educated workers primarily due
to returns to education or variations in college premiums (Zimmerman, 1992). Increases in bifurcated or dual labor markets are the consequences of differences in racial educational attainment and returns, especially among men. Prior to the 1980s, the occupational dissimilarity between black and white men flat-lined following a decline for the five previous decades, resulting in persistent earnings inequality and returns to schooling (King, 1992). Since then, explanations of racial earning and employability differences were attributed to variations in college enrollments, attitudes, and returns differences (Beattie, 2002). Bound and Freeman (1992) addressed loss of earnings gains by black men following the demise of segregation in the 1980s, and assert that the erosion was due in part to the failure to continue to increase levels of college attainment from the two previous decades. Perna (2000, 2004) concluded that measurable attitudinal differences explained variations in returns and attainment of increasing levels of education by black and Hispanic men relative to their white counterparts. Earning and employment stability variations result from differences in completing and attaining increased academic levels.

In the absence of discrimination literature, the most enduring arguments for racial earnings inequality are human capital differences, occupational segmentation, and returns to attained schooling. Despite the paucity of recent literature, there is an

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3 College premium is the average earnings difference between post secondary and secondary education levels, whereas returns to schooling is the percentage increase in earnings capacity net of the cost of attaining additional levels of education.
increasing body of research that greater levels of education attainment and migration are two major investments that potential workers undertake to improve future earnings. Immigrants incur moving costs (sunk-cost) to move from low-income regions to high income along with marginal-cultural transfers (psychic) cost associated with adjusting of job search (BöImark, 2008; Long and Heltman (1975). Attaining higher levels of education allows indigenous workers to capture greater economic rents as their labor supply curve becomes increasingly inelastic. Investing in additional levels of college education is costly, because workers forgo earnings opportunities, incur tuition cost, and in most cases repay college costs through long-term financing.

Solon (1992) offers an intergenerational and familial transfer model that showed a positive and significant correlation between earnings of fathers and sons of roughly forty percent, due in part to increasing returns to additional years of schooling over the previous generational levels. Carliner (1976) presented evidence that returns to education for white men were thirty percent higher than for black men in the 1970s and the predominant contributor to employment and earnings inequality among college graduates. He concluded that educational returns vary due to pervasive discrimination, differences in school quality, cultural or attitudinal differences toward education, and variations in black-worker occupational preferences. Carliner suggests that as more
black men increase their levels of education, the earnings gap will remain constant or even widen.

Fisher (1932) argued in his seminal work on investment returns to education that as the supply of college trained workers increases college premium and returns to education will eventually dissipate. That is, the least educated workers would capture a risk premium because the supply of less educated workers performed the dirtiest and riskiest occupations. Becker (1960) challenged Fisher’s assertions and was among the first to present arguments for a persistent college premium, or returns to a college education. He suggested that such gains would persist indefinitely because college trained workers always possess higher marginal productivity. Becker, on the other hand, argued against marginal returns increasing as the number of educated workers who invest in college level human capital rises. Further, he argued that as the workers capture higher returns from educational investments, gains to human capital investments will exceed gains from investments in physical capital investments, and the earnings gap between those with a degree and those with only a diploma will further widen. During the decade of the 1970s, numerous studies reverted to Fisher’s notion and found investments in a college education were overstated and the college premium would eventually evaporate. These arguments came in response to the expanding enrollment during a decade of ballooning college graduations; the advent of expansions
in Pell grants, designed to reduce educational attainment among underprivileged and under-educated groups; reestablishing the educational component of the GI bill to Vietnam veterans; and expansion of national defense student loans. Freeman (1975, 1977), Smith, and Welch (1989) who suggested that the supply of educated workers would decline the economic value of a college degree by the year 2000, were among the many researchers to challenging Becker. O’Neill (1990) and Taylor (1981) advanced the human capital approach, suggesting that whites invest more dollars in education and that their higher returns to education reflect greater productivity due to greater investments in school quality no matter the level of education.

Blackburn and Neumark (1991) were prominent among those to argue that returns of college premiums without inclusion of an ability bias controlling for race and gender were understated. Ability bias is a powerful argument for comparative worth across race and gender, but it rest on the assumption that standardized test scores, such as the Air Force Qualification Test (AFQT) or IQ are perfect measures of ability or productivity. This position gained in prominence, yet is not prevalent. Oettinger (1996) and Schwab (1986) were among this growing cluster of researchers to challenge prevailing notions by asserting that black men actually capture higher returns to schooling than their white counterparts. For them, most research did not account for ability-bias that overstates returns to white men and understates the returns for black
Dachter-Loury (1997) took a divergent position to prevailing labor research on gender earnings inequality and acknowledged a narrowing of the earnings gap. She further argued that increases in labor force participation lessened discrimination, but established research had not controlled for schooling characteristics such as number of years to completion, grade point average, and college major(s). Link (1988) applied a multinomial-logit model to estimate the marginal effects of experience, hours worked, personal characteristics, and workers health as a measure of returns to education in the nursing profession. By including a bias coefficient, Link estimated a wage probability function (using hourly wages) that controls for a set of latent variables reflecting human capital. These methodologies deviate from established standards, which take the simple mean or median differences between college and high school only graduates. Maxwell (1994) presented a model of black-white earnings inequality as a bias ability-correction method that measures returns to schooling based on the number of years by controlling school quality. Wiesbrod and Karpoff (1968) argued that earnings differential between those who gain an additional level of education are attributed to non-educational factors such as ability, experiences, and motivation. Still others argued more profoundly that human capital, ability, and the absorptive capacity almost exclusively account for earning differences (Krusell, Ohanian, Rios-Rull & Violante, 2000).
This study measures net returns to schooling by estimating elasticities for each academic college level as the difference between wage-returns net of the present value of educational cost for four levels of education above high-school, namely associates, bachelor’s, master’s, and doctoral degrees. The methodology following Carliner’s estimations captures the proportional returns due to a relative percentage change in exogenous factors such as labor market experience, race, and previous years of schooling, but does not imply a spurious ability bias. Using the Current Population Survey (CPS), 1987-2004, this study examines returns to schooling for five academic levels: high school to doctoral degrees. The next section describes data from the CPS research sample that develops the underlying hypothesis that followed by a generalized model of returns to schooling for increasing levels relative to the previous level. The following section provides a regression model study using the log of weekly earnings as the endogenous variable controlling for years of schooling, race, urbanization, ability, and labor market experience followed by a summary of the study.

Data Description

This study used Current Population Survey (1987-2004) that originally included six million individual and household observations collected randomly across the U.S. by the Bureau of Labor Statistics (BLS). To meet the objective of this study to examine exclusively the returns to education of employed and educated black and white men,
the sample was reduced by removing women, persons not self-classified as black or white, persons under 16 and over 64. Excluding these groups, the sample was reduced to 2,746,319 subjects, where black men make up 7.43 percent or 204,108 responding observations with white men account for the balance of 92.57 percent. The difference in the proportion of black men relative to the overall proportion of black men in the economy reflects lower representation in the labor force due to an array of factors, primarily incarceration rates (Freeman, 1996).

Mean weekly earnings for black men in the resulting sample were $406.40 and $541.07 for white men, where white men earned on average $7,000 more annually or one-dollar and thirty-three cents for each dollar earned by black men. Mean years of schooling completed by white men was 13.1426 and 12.537 for black men, a difference of roughly nine months more for white men. Eighty-two percent of black men and eighty-seven percent of white men completed high school in this research sample. These statistics are consistent with the Economic Report of the President (1999) that eighty-eight percent of both black and white men ages 18-26 had completed a high school diploma or its equivalency. The average age of white men was 37.61 and 36.56 for black men, who were younger by roughly 1.1 years. The difference was significant enough to use age as an explanatory variable. The overall unemployment rate in this sample for black
men was 9.73 percent and 4.41 percent for white men, with the unemployment rate for all black men 2.21 times the rate for white men.

According to the *Statistical Abstract of the U.S. 2004*, in 1960 only one in five black men and two in five white men possessed a high school diploma. By 2004, the proportion had risen to 80 and 85.1 percent respectively. Further, in 1960, 10.3 percent of all white men and 2.8 percent of all black men earned at least a four-year college degree. Two decades later, the percentage of black men with a four-year college degree had tripled to 8.4 percent and doubled to 21.3 percent for white men. Between 1980 and 2004, the percentage of black men with at least a bachelor’s degree doubled to 16.7 percent and the increase for white men was to roughly 30 percent. Over the forty-five year period, the number of white men with a college degree tripled and rose six hundred percent for black men. For black men the significant benefit for completing a college degree was higher relative earnings for those who had completed college relative to black non-college graduates. This is also true for white males. The reduction in unemployment risk and earnings inequality was marginal for black men relative to white men.

Table 1 shows the mean earnings and comparative unemployment rates for white and black men, extracted from the research Current Population Survey sample used in this study, who reported completing an academic degree for each of the five
This table provides the hypothetical underpinnings for this study, measured in both absolute and relative terms. This summary shows that black men with only a high-school diploma earned eighty-cents for each dollar earned by their white counterpart similarly educated and were unemployed at a rate 2.11 times higher. Among men who had attained an associate’s degree, black men increased their weekly earnings, but no improvement occurred. Overall, the employability of black men with an associate degree improved significantly, but relative to their white counterpart, there is no significant change at every academic level. Black men were still more than twice as likely to be unemployed.

### Table 1. Summary Statistics: Mean Weekly Earnings and Unemployment Rates for Each Level of Attained Education, 1987-2004

<table>
<thead>
<tr>
<th>Level of Education Attained</th>
<th>Mean Weekly Earnings</th>
<th>Relative Earnings B/W</th>
<th>Unemployment Rates</th>
<th>Relative Rates B/W</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Black Men</td>
<td>White Men</td>
<td></td>
<td>Black Men</td>
</tr>
<tr>
<td>High School Only</td>
<td>$466.81</td>
<td>$581.01</td>
<td>$0.802</td>
<td>9.96%</td>
</tr>
<tr>
<td>Associates Degree</td>
<td>595.76</td>
<td>735.85</td>
<td>0.809</td>
<td>5.21</td>
</tr>
<tr>
<td>Bachelors Degree</td>
<td>756.79</td>
<td>960.46</td>
<td>0.798</td>
<td>3.92</td>
</tr>
<tr>
<td>Masters Degree</td>
<td>915.29</td>
<td>1121.29</td>
<td>0.816</td>
<td>3.36</td>
</tr>
<tr>
<td>PhD</td>
<td>1103.97</td>
<td>1303.99</td>
<td>0.846</td>
<td>2.85</td>
</tr>
</tbody>
</table>


As would be expected, black men who attained a bachelor degree earned sixty percent more than a black man with only a high-school diploma. Relative to their white
counterpart with a bachelor’s degree, earnings improved by only 0.004 cents per dollar, but significant relative improvements occurred in the unemployment rates. For those who had attained a bachelor’s degree, the relative black-white unemployment rate dropped by 22.75 percent and by sixty-one percent among black men with only a high school diploma. Gains were more profound among black men with a master’s degree. Compared to black men with a high-school diploma, earnings doubled and the rate of unemployment dropped by sixty-six percent relative to white men.

Table 2. Percentage of Workers in Class of Workers by Attained Degree Levels Using CPS, 1987-2004

<table>
<thead>
<tr>
<th>Black</th>
<th>Private Sector</th>
<th>Federal Government</th>
<th>State and Local</th>
<th>Self Employed</th>
<th>Without Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Only</td>
<td>78.42</td>
<td>4.47</td>
<td>11.64</td>
<td>4.5</td>
<td>.95</td>
</tr>
<tr>
<td>Associates Degree</td>
<td>64.30</td>
<td>8.92</td>
<td>20.81</td>
<td>5.49</td>
<td>.046</td>
</tr>
<tr>
<td>Bachelors</td>
<td>63.47</td>
<td>8.70</td>
<td>22.83</td>
<td>4.89</td>
<td>.12</td>
</tr>
<tr>
<td>Masters</td>
<td>50.75</td>
<td>5.66</td>
<td>37.92</td>
<td>5.47</td>
<td>.19</td>
</tr>
<tr>
<td>PhD</td>
<td>50.43</td>
<td>8.70</td>
<td>28.69</td>
<td>12.17</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>White</th>
<th>Private Sector</th>
<th>Federal Government</th>
<th>State and Local</th>
<th>Self Employed</th>
<th>Without Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Only</td>
<td>79.21</td>
<td>2.33</td>
<td>6.86</td>
<td>11.29</td>
<td>.31</td>
</tr>
<tr>
<td>Associates Degree</td>
<td>74.02</td>
<td>4.78</td>
<td>11.34</td>
<td>9.71</td>
<td>.14</td>
</tr>
<tr>
<td>Bachelors</td>
<td>73.52</td>
<td>4.38</td>
<td>12.15</td>
<td>9.83</td>
<td>.12</td>
</tr>
<tr>
<td>Masters</td>
<td>60.86</td>
<td>4.82</td>
<td>25.72</td>
<td>8.52</td>
<td>.08</td>
</tr>
<tr>
<td>PhD</td>
<td>59.09</td>
<td>3.32</td>
<td>10.39</td>
<td>27.24</td>
<td></td>
</tr>
</tbody>
</table>


However, black men gained one and one-half cents per dollar earned by white men who were similarly educated. Earnings for black and white men were highest for those with doctoral degrees, but black men increased their relative earnings by only
four and one half cents per dollar over those with a high school diploma, and three cents over those with masters’ degree. Although the unemployment rate for black men was lower than for all lower education levels, the relative unemployment rates was highest for those with a doctoral degree.

Farley and Allen (1987) reported that government agencies employed two-thirds educated black workers in the United States between 1970 and 1985. Workers employed by a governmental agency tend to earn less than those in the private sector who are similarly educated. Accordingly, Farley and Allen suggest in the modern economy, that blacks are more likely to seek employment in the public sector in order to reduce their exposure to earning and employment discrimination. Black workers are then less risk-averse and are willing to give up earnings in order to attain some measure of employment security.

One of the major sources of earning inequality among classes of educated workers is the distribution among private, public sectors, and the self-employed. Fairlie and Meyers (2000, 1996) found that the more advantaged a racial group the more likely they are to be self-employed, and, by extension, less likely to be employed by a governmental agency. Implicitly, the more likely a racial group is to face discrimination, the more likely that group is to seek protection in public employment. Table 2 is a summary of sector employment by educational levels for black and white men from the
data sample used for this study. White men were more likely to be self-employed or employed in the private sector by more than ten percent than black men. There is virtually no discernable difference between the proportion of black and white men employed by the private and public sector. The proportion of black men employed by the federal government is twice the rate of white men, no matter the level of education.

**Model**

Returns to education of black men vary significantly more than the returns for their white cohort and the college premium for white men is significantly higher Card (2001). This paper examines the intra-racial college level premium and inter-racial differences by taking into account opportunity cost paid over a workers work-life. Previous studies fail to take account of net returns as the difference between earnings and educational investment cost, that reduces returns for college educated workers. High-school graduates do not incur this cost. The college level premium, CP is the difference between the mean annual earnings of a specific level of college-educated workers over the average earnings of workers of one less level of college. This premium is an educational level premium where mean annual earnings $\bar{Y}_i$ for higher level of education net of mean annual earnings from a previous level of education, $\bar{Y}_{i-1}$, not controlling for occupational distributions, market experience, ability-bias, urban-rural location, race or unemployment risks. More formally,
The rate of returns to schooling of the $i^{th}$ level of education is the percent increase in mean earnings over the previous certificated level of education. More formally,

$$CP_i = \frac{\bar{Y}_i - \bar{Y}_{i-1}}{\bar{Y}_{i-1}} \quad (1)$$

Equations (1) and (2) are classical generalized definitions that do not account for variations in unemployment or sunk cost by investing in additional levels of college education. Cost $C$, are the positive pecuniary amounts of forgone earnings and outlays for books, tuition, and other living costs, where the net college premium NCP is then;

$$NCP_y = \frac{\bar{Y}_i - \bar{Y}_{i-1}}{\bar{Y}_{i-1}} - C_y \quad (3)$$

where $C_y=0$ for high-school only graduates. The NCP is a measure of returns to schooling that includes measurable additional cost for completing additional each levels of schooling up to the attained level. Costs are annuitized and represent a future claim against annual income or earnings streams and are amortized at the opportunity discount rate for investing in alternative projects that represents the cost or negative returns to education. If a worker graduates at the highest level of college at time $t$ and retires at $T$, so that the work-life of each worker is:

$$\tau_t = T_t - t_t \quad (4)$$
then the cost of education up to a specific level is the sum of all previous costs since graduating from high school is assumed to be a fixed amount, $C_E$. This amount is a claim against annual earnings re-paid over $\tau_i$. Annual payments to maturity or retirement are claims against future earnings streams for $\tau$ years at market or discount rate $r$, for each year to retirement is:

$$a_{ti} = \frac{rC_E}{1 - (1 + r)^{-\tau}}$$

(5)

So that for any given year this amount is zero for high-school only graduates and net college premium is then:

$$ncp = (\bar{Y}_t - \bar{Y}_{t-1}) - a_t$$

(6)

As the level of education increases, annual repayment amounts are higher and $a_t \geq a_{t-1}$ because $C_t \geq C_{t-1}$. Each worker’s net discount returns to a specific level of education $\rho$, is the net college premium from completion of the highest level of education where the total cost of education is repaid over the worker’s work-life, their net present value of expected earnings until $T$, is then:

$$E(\rho) = \sum \frac{(ncp)}{(1+r)^t} \cdot f(\varepsilon)$$

(7)

where $f(\varepsilon)$ is the relative frequency or probability of stable employment as a measure of unemployment risk for each level of certified years of schooling. Future workers invest in years of schooling and care about absolute and relative-risk rates of returns to
education. Educational investors are rational in the sense that they compare expected returns between any two alternatives and select the project with the highest net returns. If however, investors with specific immutable characteristics routinely perceived that their return to education is lower than another group, their investment decisions will differ.

**College Cost**

Equations (8-12) estimate net return to earnings for additional levels of college education using explicit earnings and unemployment rates. The left-hand side of equations (9, 11, and 13) is log of net annual earnings reported by each respondent and discounted over a repayment period of the estimated years of a worker’s work-life at four percent interest. Right-hand side variables are race, labor market experience, and a set of regional dummies. Implicit costs estimates the opportunities of forgone earnings given up while investing in a college education not included in the CPS sample. Table 3, shows the cost of college education estimated using an average of college costs from an extract by the National Center for Education Statistics (NCSE) of annual costs for each level of education for the academic year ending in 2000, for black and white men. Associate degrees, two-year certifications, and the annual repayment or claim against earnings is $571.36 for white men and $583.04 for black men for thirty years at four percent. Bachelor certification is a four-year degree costing a total of $35,336 for white
men and $35,304 for black men, and five years for masters degrees for an additional $8,834 and $8,826 respectively. These values include tuition, books and supplies, room and board, transportation, and personal items allowed by federal assistance. To maintain consistency, the author assumes only full time full year students and excludes those who attended more than one institution. The value for each level of education estimates the annual claims against earnings to determine the net returns to a college education.

<table>
<thead>
<tr>
<th>Race</th>
<th>Public two-year</th>
<th>Non-Doctorate</th>
<th>Doctorate</th>
<th>Annual Claim-Payments For Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>$4,940</td>
<td>$8,834</td>
<td>$10,878</td>
<td>Associates: $571.36, Bachelors: $2043.48, Masters: $2554.35, Doctorate: $4529.34</td>
</tr>
<tr>
<td>Black</td>
<td>5,041</td>
<td>8,826</td>
<td>10,655</td>
<td>583.04, 2041.63, 2552.04, 4436.49</td>
</tr>
</tbody>
</table>


Methodology

This section estimates the internal rates of return to schooling or of an additional level of education in terms of earnings and unemployment risk for black and white men. The paper will first estimate net returns to schooling for black and white men, and then compare this value for each racial group with the market rate of interest paid by all workers. Using modified rudiments of Link (1988), Blackburn and Neumark (1992), Mennemeyer and Gaumer (1983), and Booton and Lane (1985) to estimate the net
returns to schooling for black and white men and compare that value to a fixed market rate of return of five percent. The estimation annualizes weekly earnings from the Current Population sample net of the estimated annualized cost from Table 2 assigned to respective racial respondents in the sample. The endogenous variable for equations (10) and (11) is the natural log of annual earnings for each respondent’s level of academic education. The methodology takes the natural log of this value as the endogenous variable and controlling for race (black=1), labor market experience, regional variables (south, rural), years of schooling and marital status. The result value measures the net percent change in earnings resulting from an additional level of education. This estimation applies the natural log of unemployment rates as the endogenous variable, controlling for the same exogenous descriptors. The specification and estimation for measuring returns to race, regional location, educational level, and marital status on both net earnings and unemployment risk is the Cobb-Douglas in the form:

\[
UNR = \alpha_0(labor\text{MarketExp})^{\alpha_1}Region^{\alpha_2} + unDEV^{\alpha_3} \gamma(Race)^{\alpha_4} \tag{8}
\]

\[
NE = \beta_0(labor\text{MarketExp})^{\beta_1}(Region)^{\beta_2}ear\text{DEV}^{\beta_3} \delta\text{Race}^{\beta_4} \tag{9}
\]

Equation 8, measures returns to unemployment resulting from a proportional increase in the right-hand side variables for each specific level of education. If \( \sum \alpha_i = -1 \) the

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\(^4\) Estimated labor market experience is each worker’s age minus six, minus the number of years of schooling.
model implies constant returns to unemployment for a specific level of education or a
decrease in unemployment by one percent due to an increase in all right-hand side
variables of one percent for the specific level of education. Similarly, equation (9)
estimates returns to schooling using net earnings and if the estimator
suggests constant returns to education for that specific level. Race is an additive (shift)
dummy in both equations.

Equations (10) and (11) estimate the returns to education for men with only a high
school diploma, with education being fixed and thus not represented as an exogenous
variable, representing years of schooling. The exogenous variables are labor market
experience; regional dummies are interactive with race and a non-dichotomous regional
code for the south or non-south. By using a rather simplistic dual-additive log
regression model, one can measure the percentage change of the endogenous variable
resulting from a one-unit change in the exogenous variable, at each level of educational
attainment. The measurement for the likelihood of unemployment for high school only
graduates produces:

\[ \ln(\text{unem}) = \ln(\beta_0) + \beta_1 \ln(\text{imexper}) + \beta_2 \text{race} + \beta_3 \ln(\text{interreg}) + \beta_4 \ln(\text{unDEV})\epsilon \]  
(10)

And for earnings

\[ \ln(\text{netearn}) = \ln(\beta_0) + \beta_1 \ln(\text{imexper}) + \beta_2 \text{black} + \beta_3 \ln(\text{interreg}) + \ln \alpha_4 \text{earDEV} + \epsilon \]  
(11)

Regression framework for college graduates at each level of education complete is:
\[ \ln(wages) = \ln(\beta_0) + \beta_1 \ln(mexper) + \beta_2 \ln(married) + \beta_3 \ln(interrreg) + \gamma \ln(black) + \varepsilon \] (12)

And for unemployment:

\[ \ln(unempi) = \ln(\alpha_0) + \alpha_1 \ln(mexper) + \alpha_2 \ln(married) + \alpha_3 \ln(interrreg) + \delta \ln(black) + \varepsilon \] (13)

where \( \gamma \) and \( \delta \) are shift dummies for the respective estimation.

**Findings**

Table 4 presents estimated elasticities measuring returns to schooling and shift parameters for equations (11-13) of black and white men unemployment and earnings, for each level of education. Exponential coefficients are the elasticities of returns to each level of education resulting from a one percent change in the right hand side variables such as labor market experience, marital status, and deviation from-group mean interactive regional category. The results for each academic level of high school and beyond are the summation of elasticities, the marginal returns for the respective right hand side variables are the percentage change in net earnings or unemployment attained at each level of education for equations (8) through (13).\(^5\) Race coefficients for each respective group do not measure direct-elasticities as it is a shift dummy and thus measures the change in returns from a each additional worker of that racial group.

\(^5\) For each coefficient \( \hat{\beta} \) is elasticity or marginal contribution to returns of the partial derivative of the endogenous variable with respect to the 

\[ \frac{\partial \ln Y}{\partial \ln X} = \frac{\hat{Y} \cdot \hat{X}}{\hat{Y} \cdot \hat{X}} = \eta_x \]
Consistent with previous research that does not account for an abstractive ability-bias, returns for black men are lower than for white men at each level of education. Regression outcomes are also consistent with summary hypothesis outlined in table 1. Return to race for black and white men with only a high-school diploma, suggests the least inequality of earnings returns to schooling. Although the coefficients for race are statistically insignificant, the differences in absolute earnings and unemployment are significant. Implications are that among this educational class, employment discrimination does not persist and, as shown in table 2, earning differences may result from self-employment, where white men gain an advantage.

For this study, there are three general observations; the estimated coefficients for returns are all positive, suggesting that human theory investments in additional levels of schooling benefit all investors in education and decreasing returns to educational levels in both earnings and unemployment reductions. Secondly, consistent with a priori assumptions, returns to schooling for white men are greater than for black men, taking into account the opportunity cost of education. Lastly, the returns to attaining college degrees exceed the benefits to attaining only a high school diploma, when taking into account the additional cost incurred to make the investment. There is strong evidence to support the hypothesis that there is a persistent positive educational earnings premium as measured by the earnings and unemployment elasticities. In
terms of race, there is evidence that racial returns to education will persist indefinitely. Although the race coefficient is positive for black men, it is much smaller and is barely significant.

Returns to each level of education are captured by the summation of the exponentials of the right-hand side exogenous variables. Results for equations (10) shows that net earnings-returns for black men who completed only high school are 0.638 compared to 0.742 for white men. Labor market experience accounted for twenty-seven percent of returns, and additional education accounts for 73 percent of returns. Black men who completed high school decreased their unemployment risk by 0.842 percent compared to 0.925 for white men. For black men who have completed a bachelors degree, evidence shows that net earnings returns was 0.85 compared to 0.954 for white men, while returns to labor market experience is twenty percent higher for black men than for white men. For men with a bachelor degree, returns to net-earning are 12.2 percent higher for white men with the same level of education. There are marked reductions in relative unemployment elasticities in favor of white men. The racial reduction in unemployment for white men is -0.24 compared to -0.121 for black men, yet outcome shows that increased education reduces unemployment for both races.
At the graduate levels, doctorates and master’s degrees, net return is highest for black men, but lower than for white men with the same degrees. Returns for black men was 0.956 and 1.012 for white men with a doctorate degree, suggesting increasing returns for white men and near constant returns for black men, but with an advantage to the former. Black men fared even worse with respect to returns to unemployment, exhibiting decreasing returns at 0.83 compared to white men at 1.22. This implies that white men reduce their risk of unemployment by one-third the rate of black men, at the same level of education. Returns for master’s degree earners are 0.851 for black men, compared to 1.03 for white men. Reductions in unemployment risk-returns are by 5.1.

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| Education      |       |       |       |       |       |       |
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| R²             | .68   | .72   | .69   | .64   |
| R²             | .68   | .72   | .69   | .64   |

178
Table 5 extracts estimates (shift parameter) that measure the pure-race effect from Table 4 shows ‘own-race’ variable affect on additional levels of education for each race. Black and white men who have completed high school, returns to earning are twelve percent and seventeen percent more than their cohorts who did not graduate. Workers reporting only an associate’s (generally a two-year) degree capture the lowest returns for both black and white men. This educational group also receives the lowest reductions in unemployment. By comparison, black men with doctorate degrees capture lower returns to education and greater reductions in unemployment among blacks, but lags behind educational benefits relative to their white counterpart in both earnings and unemployment.

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Number of Observations | 85,489 | 19,245 | 1,142,241 | 189,177

Note: The coefficients measure the percentage change in net-earnings due to a one-percentage change in the respective exogenous variable. Values in parenthesis are the standard errors of the respective exogenous variable. The education coefficient measures the change in earnings from the previous level of education of the parenthesized levels. Negative values of unemployment regressions (10) and (13) suggest that unemployment rate drops as the respective coefficient increases.
Table 5. Race Effects: Returns to Earnings and Unemployment Risks for Black and White Men

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Conclusion

Barrow and Rouse (2005) found measurable and insignificant evidence of differences in returns to schooling between blacks and non-blacks. Their finding suggests some selection bias and measurement errors but no ability bias using the AFQT, a measured variable in their longitudinal study. This study does not address selection bias or compensating variation which concludes that black men show lower ability coefficients as measured by intelligence quotient tests. Inclusion of these test scores tends to bias down returns to college for white men and biases up the coefficients for black men. The author used an abstraction for the Current Population Survey cross-sectional pooled data (CPS) 1987-2004 which does not include respondent ability attributes. Contrary to their findings however, this research found significant variations in the returns to schooling between black and white men for both earnings and unemployment, not controlling for the abstract notion of ability bias.
This study raises two queries. The first is whether it is worth investing in additional levels of schooling beyond high school by black men, when taking the cost of pursuing additional levels of education in consideration. Secondly, does attaining additional levels of education reduce earnings inequality? This study concurs with the literature that net-return to education for black men at all levels are lower than for their white counterpart, in terms of unemployment reduction and earning gains. Increasing levels of education by black men do not tend to reduce earnings inequality, but increase intra-racial earnings and employable variability. Lastly, intra-racial returns comparisons suggest that black men who invest in a college education actually capture greater returns over their earning-life.
References


Student Attrition Among Freshmen and Sophomores At A Historically Black Institution

Harold Henderson
Director for Accountability and Retention
School of General Studies
Florida A&M University

Abstract

Student retention is crucial to the long-term health and viability of all institutions of higher education. This is most evident in the large body of research undertaken in the last thirty years to understand the causes and implications of student attrition. Yet, remarkably little is known concerning the attritional behavior of African American students. By the mid-1990’s blacks accounted for just under 12% of full-time freshman enrollment in America’s four-year colleges and universities (The Black Collegian Magazine, 2005); as recently as 2001, this ethnic group was awarded only 8.9% of all baccalaureate degrees (U.S. Bureau of the Census Statistical Abstract, 2003). In this investigation, an informal telephone interview was conducted with approximately 150 freshman and sophomore students who had officially or unofficially withdrawn from a large, public historically black university. This survey will be used to determine the factors underlying African American student departure. As part of this investigation, the post-matriculation academic characteristics of students who left the university and the onset (first occurrence) of departure were also examined. The findings indicate that a) early departers include many high performing students, and b) a possible correlation exists between student persistence and the point of entry into college. A series of recommendations are proposed which, if implemented, could improve the rate of recovery of departed students and increase students’ chances for sustained success the second time around.

Background

Regardless of level or type, public or private, two- or four-year, community college or research university, student attrition is the bane of all postsecondary institutions. Millions of dollars are expended annually in understanding its causes and
subsequent effects. Countless millions more are invested in pursuit of its eradication and prevention. Henderson and Gavin (2004) write, “Student attrition affects both the student and the institution from which the student withdraws. It impacts the institution’s operations and finances through the loss of tuition and the cost of recruiting additional students. Student attrition also affects the institution ethically.”

Research studies show that nearly half of all college students depart before beginning their sophomore year. Cuseo posits that the most common causes of college attrition are academic underpreparedness, academic boredom, transition to college adjustment difficulties, uncertainty about educational or occupational goals, isolation, irrelevancy, low commitment, and financial problems.

The Undergraduate Experience Program (UEP, formerly the Freshman/Sophomore Year Experience) was implemented at Florida A&M University (University) in an effort to significantly improve the retention, academic progression, and graduation rates of students and, conversely, to reduce the incidence of attrition. This is accomplished through a variety of activities and experiences designed to promote positive interactions in the freshman and sophomore years. To encourage departing students’ return to the institution, the UEP also includes a reclamation component. Under the reclamation process, students are contacted within two weeks of
their departure from the institution and at least once every other month for up to one full academic year.

Scope

Pursuant to the mission and goals of the UEP, academic advisors were directed to contact students who did not reenroll in the University (referred to as stopouts). The issues addressed in this investigation are as follows:

- Why do students depart?
- How likely are students of returning?
- What assistance can be made available to improve the chances of students returning?

Methodology

Students matriculating through the UEP who did not reenroll in classes at the University in the spring 2007 semester were the audience for an informal telephone interview conducted by academic advisors. The students chosen for the survey were drawn from the spring 2005, summer 2005, and fall 2005 first-time-in-college (FTIC) cohort. A detail (listing) of stopouts was generated based on a matching of student databases with enrollment reports and unofficial transcripts. Telephone numbers were obtained from available University or departmental records. Whenever possible, messages were left after unanswered calls and in some instances, second calls were
placed. Phone interviews revolved around three basic questions: (1) *What are your reasons for leaving the University?* 

(2) *What are your plans for returning and, if likely, when?* (3) *What help could be provided by the University to assist in your return?* Data collected during the interviews were documented in the form of electronic spreadsheets and summarized for analysis.

**Analysis**

UEP academic advisors identified approximately 150 FTICs matriculating into the University during the 2005 calendar year who were not enrolled during spring 2007. Fall 2005 FTICs made up almost eighty percent of this total with slightly over twenty percent represented by students in the spring 2005 and summer 2005 cohorts (see Table 1).

**Table 1. Stopout Population**

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Number of Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2005</td>
<td>16</td>
<td>11.0%</td>
</tr>
<tr>
<td>Summer 2005</td>
<td>17</td>
<td>11.6%</td>
</tr>
<tr>
<td>Fall 2005</td>
<td>113</td>
<td>77.4%</td>
</tr>
<tr>
<td>Composite Total</td>
<td>146</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

An early exit by a student (i.e., completion of only one semester or withdrawal from the University during the initial term of enrollment) is problematic for an institution in that (1) not enough time may have passed for the student to be placed in a jeopardy situation (e.g., academic suspension); (2) the departure decision could be more
voluntary than involuntary in nature; and (3) the decision may have precipitated from some level of personal dissatisfaction or goal confusion.

From an analysis of enrollment patterns, the author determined that a significant percentage of stopouts (roughly thirty percent) withdrew from the University following the completion of the initial (and only) semester of enrollment. Students in the spring 2005 cohort were six times more likely to stop out after one term than their summer peers, and almost three times more likely than their fall peers (see Table 2).

**Table 2. Timing of Early Withdrawal**

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Number of Stopouts</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After One Term</td>
<td>Total</td>
<td>Percentage</td>
</tr>
<tr>
<td>Spring 2005</td>
<td>11</td>
<td>16</td>
<td>68.8%</td>
</tr>
<tr>
<td>Summer 2005</td>
<td>2</td>
<td>17</td>
<td>11.8%</td>
</tr>
<tr>
<td>Fall 2005</td>
<td>29</td>
<td>113</td>
<td>25.7%</td>
</tr>
<tr>
<td>Composite Totals</td>
<td>42</td>
<td>146</td>
<td>28.8%</td>
</tr>
</tbody>
</table>

As is depicted in Figure 1, the overwhelming percentage of stopouts ceased enrolling in classes at the University after their first full academic year (i.e., completion of one fall and one spring semester).

**Figure 1. Number of Stopouts After One Full Academic Year and in Spring 2007**

Spring 2005 Cohort

Number FTICs not enrolled spring 2006

[12]

Number FTICs not enrolled spring 2007

[16]
Stopouts represented a fairly diverse group of students in terms of the level of academic achievement. The highest one-third earned cumulative grade point averages of 2.0 or above. Most frequently, students were found to be placed on academic warning (see Figure 2).
Not unexpectedly, there was a significant difference between the average length of stay of students placed on first and second suspension and all other students (3.33 vs. 1.96 semesters). However, the lengths of stay of dean’s list and honor roll students were virtually equal to that of their lesser performing peers on academic warning (see Figure 3).
Results

Of the nearly 150 students identified for inclusion in our survey, responses were obtained from twenty-five students with additional responses collected from persons close to three other students (a nineteen percent response rate). These responses are further discussed below.

- Why do students depart?

Twenty-two students furnished responses on the factors leading to their decision to leave the University. An equal number (twenty-three percent each) stated
for academic or financial reasons. Two students listed reasons that could best be
classified as personal. The remainder (forty-five percent) rendered various explanations
ranging from parental conflict with University and enrolled in another institution to
being inducted into military service. Most of the latter or remaining students had, in
fact, enrolled elsewhere.

- **How likely are departing students of returning?**

  Based on a small number of responses, the likelihood of most students returning
to the University perhaps range from questionable to improbable. Ultimately, a return
to college for many of these students will depend primarily upon a firm commitment to
a plan of action (i.e., preparation) to remedy standing concerns.

  From the responses of thirteen students, four expressed an interest in returning
to the University while nine expressed no interest. One student who expressed an
interest in returning had already enrolled at another in-state, public institution. Another
student expressing an interest disclosed that she was working at home and would be
attending a community college. And a third student reported a specific return date. A
subsequent review found that two students had in fact re-enrolled.

- **What assistance (if any) can be made available to improve the chances of
students returning?**
A viable program of recovery should anticipate returning students’ needs in advance and marshal the necessary resources to ease their transition. In addition to the tangible benefits that such assistance could yield, the boost to a student’s emotional and psychological well-being is incalculable. Two respondents enquired about information on campus services for students with dependent children. One student made a solicitation for scholarship assistance.

**Limitations**

From the beginning, this investigation was subject to flaws in the format of the interviews and uncertainty regarding the size of the population. A further limitation was in the low overall rate of responses. A separate examination of each follows.

**Population**

The stopout listing did not reflect all colleges and schools and the true stopout population is unknown. Notable omissions in the stopout listing included cohort students from the College of Engineering Sciences, Technology, and Agriculture (CESTA), the Environmental Sciences Institute, and several programs under the College of Arts and Sciences, the College of Education, and the School of Allied Health Sciences. Although it is conceivable that these units had no departing students, the possibility is remote especially since the assigned advisors failed to respond to several requests for information.
Moreover, continued system and programming errors provide little assurance as to the accuracy and reliability of FTIC counts. Misstated counts result in likely misstatements in the number of stopouts.

*Interview Format*

There were no uniform guidelines as to the content and typology of interview questions. Phone interviews were conducted without the use of a formalized instrument or protocol to ensure uniformity in question content and type. As noted in the previous section, many interviews failed to document a reason for leaving, whether or not a student had any intentions or expectations of returning, or what assistance might be helpful under the circumstances. Consequently, variation did exist in the coverage given to questions and in the manner in which questions were framed.

In a fact-gathering setting, a combination of close- and open-ended questions would be ideally suited. For example, a direct question posed “Why did you leave the University?” might result in a non-elaborative response such as “financial” (close-ended question). A more penetrating, follow-up question asked could be “What happened with your finances to bring you to the point of leaving (open-ended question)?”

*Response Rate*

The low rate of responses was connected to a high number of non-calls or undocumented calls and calls not returned. Less than one in two calls (forty-six percent)
resulted in a phone interview. The percentage of successful calls dramatically falls when compared to the total number of stopouts (nineteen percent). The low rate of responses can partly be attributed to non-calls or undocumented calls and partly to unreturned calls. Possible strategies that academic advisors may employ to improve future response rates are: (1) use of proven time management techniques; (2) supplemental use of mail surveys; and (3) earlier student contact.

Implications for Future Research

This investigation raises several questions which have the potential to emerge as fertile topics for future research. Do students who choose to enter the University in the spring differ in some significant way from students who matriculate at other times? Also, is there a correlation between the absence (or presence) of certain characteristics in these students and persistence and degree attainment? Earlier analyses suggest higher attrition among spring first-timers.

Anecdotally, the percentage of early student withdrawals (i.e., students who exit the institution after the completion of just one semester of enrollment) has steadily increased over time. Is this hunch corroborated by solid evidence? Likewise, are withdrawals made up by a growing percentage of high achieving students?
Questions such as these are important in gaining a fuller understanding of withdrawal behavior at Florida A&M University and in constructing effective retention mechanisms.

The investigation did not address the affect of student attitudes and perceptions on departure decisions. The congruity of students’ experiences with pre-college expectations is a known influence in the stay-or-leave decisions of many students. Even so, it may prove quite instructive to know what factors endemic to the University culture and organization present the most formidable challenges to any new or proposed retention initiative.

Recommendations

Managing student attrition is a comprehensive process that the author believes is built upon four pillars – prevention, early detection, reclamation and effective re-entry. The following recommendations are aligned to reflect this philosophy.

Prevention

- The University should commission a large-scale study on student attrition. Additionally, the task of conducting this study should be assigned to a reactivated University-wide Retention Council or special task force.
As a proactive measure, UEP academic advisors should be strongly encouraged to refer any student considering withdrawing to an appropriate campus resource(s) for additional counseling.

**Early Detection**

- The Undergraduate Experience should, in consultation with the professional literature and the Division of Student Affairs, develop red flag indicators to identify students at greatest risk of withdrawing.

**Reclamation**

- The School of General Studies through the Undergraduate Experience and the University Office of the Registrar should establish a memorandum of understanding that all students who seek to withdraw from the University must complete an exit interview with their assigned academic advisor.

- To maintain and strengthen the connection between stopout students and the University, University administration should seek ways of keeping these students abreast of campus developments and events during the separation period.
Re-Entry

To ensure a successful transition, the University should spearhead the development of a program to meet the special needs of returning students. The components of such a program should include, but not be limited to the following:

- Formal entrance appointment.
- University-wide reorientation session.
- Returning student seminar course.
- Mandatory enrichment workshops.
References


Community Relations and Partnerships with Local Churches to Assist Low Performing Schools

Patricia Green-Powell, Ph.D.

Abstract

Since the founding of the Black church, these institutions have strived to implement and fulfill their missions. Black churches acknowledge the importance to become actively involved in the community as well as engaged in the lives of young people. They are faced with unique challenges every day; however, they provide a significant number of resources to the communities at large. In this study, the author examines the role of partnerships through local churches and its affect on low performing schools using qualitative methodology. Research shows that low performing schools are influenced positively by partnerships with Black churches.

Introduction

In recent years, the importance of school community relations and overall school public relations has grown rapidly. The development of sound and constructive relationships between the school and the community are a necessary and natural function of a publicly supported institution in a democratic society. This position arises from a consideration of the public character of the school and the legal framework within which it operates. It is also supported by the role of public opinion in shaping educational policies and practices. Even though the American way of life is characterized by constant change, these considerations form the basis of the decision making process in the management of public schools, and they exercise an influence on the nature and direction of change (Bagin, Gallagher, & Moore, 2005).
Communication is a key element to building effective relationships with external stakeholders. Schools that communicate with their external public in an organized way have a better chance of receiving public support, minimizing criticism, learning the values and priorities of a community, and reducing many functional ideas that will help them to better educate students.

Too often in the past, there has been little interaction between educators and Black churches. Today, however, there is a surge of interest in partnerships between community and faith-based organizations and schools in an effort to improve schools by enhancing student learning and development. This seamless approach combines inside expertise with outside resources and support, resulting in a dual benefit: expanding services, support, and opportunities for young people, while strengthening the school as a universally available public institution for all residents. At their best, these partnerships transform schools into community schools, vital centers of life that make their facilities and resources available to their neighbors.

Church Role and Mission Versus the Constitution

In 1995, the Clinton Administration released guidelines on school and community partnerships. The guidelines addressed faith-based organizations and schools that were interested in forming partnerships. "Our new guidelines will help them work together on common ground to meet constitutional muster, to avoid making
students uncomfortable because they come from different religious traditions, while helping students make the most of their God-given talents," Clinton said.

A four-page document, published by the United States Department of Education (2003), titled "Guidelines for School Officials, Volunteers, and Mentors Participating in Public School Community Partnerships," lists some dos and don'ts in developing school community partnerships:

1) Schools that form partnerships and include faith-based communities must ensure the programs are secular, include student participants without regard to their religious affiliation, and are held in spaces that are free of religious symbols.

2) Schools should not limit participation in the partnership to certain religious groups and should neither discourage nor encourage students in regard to engaging in religious activities.

3) The guidelines also included reminders to volunteers, warning them not to pray with students, preach about their faith, or prohibit or discourage any activity solely because of its religious nature.

President Bush signed an Executive Order (EO) in 2001, allowing for increased partnerships between faith-based groups and the government. The EO created a White House Office on Faith-based and Community Initiatives to “help funnel millions of
dollars to religious groups working on social problems” (O'Keefe 2001, p. 1). The order also instructed five cabinet-level agencies (Department of Health and Human Services, Department of Housing and Urban Development, Department of Labor, Department of Justice, and Department of Education) to lift regulations that had prevented nonprofit religious groups from collaborating with the Federal Government. President Bush asked Congress to make it easier for faith-based groups to compete for federal grants traditionally obtained by secular nonprofit groups (O'Keefe, 2001).

Some groups, including African-American faith-based groups, opposed President Bush’s commitment because they viewed his EO as a violation of the Constitution's First Amendment declaration of separation of church and state. However, traditionally Black churches have had a cooperative relationship with government. According to a study of 1,236 congregations published in the 1999 American Sociological Review, "nearly two-thirds of pastors from predominantly African-American churches said they would seek government funds for social service projects. That contrasted with a mere 28 percent of conservative, mostly White evangelical church leaders” (O'Keefe, 2001, p. 2).

For years these donors shunned religious institutions, worried about the separation of church and state. But now, many have come to believe that churches, by their very nature, can supplement what they see as gaping holes in public schools,
providing moral or religious training, and treating the whole range of social ills that doom many children to failure. To avoid church and state conflicts, most donors require that funds be used for nonreligious educational programs, filling a gaping hole.

Past and present administrations have recognized the importance of church and state separation; however, they have also recognized the need for faith-based organizations to be included in the development and delivery of educational and social services. Since religious institutions are considered one of the prime sources of moral teachings in the community and based on findings that over 50% of all Americans regularly attend church, church involvement in addressing social, political, and educational problems would seem appropriate (Loury & Loury, 1997). It can be argued that the influence of the church is even greater within the Black community. The Black church has been long recognized as the oldest and most influential institution founded, maintained, and controlled by African American people (Boyd-Franklin, 1989; Taylor, Ellison, Chatters, Levin, & Lincoln, 2000). These researchers further noted that no other institution in the United States can claim the loyalty and attention of African Americans that the Black church claims.

**Low Performing Schools, Community Partnerships, and the Church**

Schools cannot achieve goals and objectives of the institution alone. Schools are discovering that faith-based and community groups can be important allies in
supporting student learning (Roehlkepartain, 2007). Low-performing schools, in particular, need the assistance of community stakeholders to raise student performance (United States Department of Education, 1998). Given the importance of the church in the Black community, it is likely that any attempts to introduce educational, social, political, economic development, or health programs to disadvantaged or minority communities would require their participation.

In the current political climate, standards-based reform is creating pressure to increase student achievement, a pressure felt most intensely by teachers and administrators. Meanwhile, community builders such as community development corporations, neighborhood-based organizations, faith-based groups, settlement houses, and others are starting to include education reform as part of their agenda to develop the community’s social, physical, economic, and political infrastructure.

In a 2003 study, researchers Mark Regnerus and Glen Elder Jr. demonstrated that when youth from low-income neighborhoods attend church, their academic performance improves. The study, commissioned by the Center for Research on Religion and Urban Civil Society, relied on data from the National Longitudinal Study of Adolescent Health to examine the relationship between religion and academics in nearly 10,000 students. Regnerus and Elder (2003) found that the poorer the neighborhood, the more church attendance helped kids to improve academically. The
findings held true even after controlling for obvious influences, such as a student's relationship with parents.

Regnerus and Elder (2003) are not the only researchers to find a link between church and academic excellence. More than 600 studies identified by the Center for Research on Religion and Urban Civil Society have also shown the positive effects of religion on physical, mental, and social health. In 2002, Loconte and Fantuzzo (2008) conducted a study that focused on social services delivered by faith-based organizations. Leaders at thirty-seven faith-based organizations from twenty-two states were interviewed. The faith-based organizations worked with public schools, correctional centers, child and family service providers, public housing agencies, and juvenile courts. The researchers found that religious organizations met the emotional needs in the lives of youth by building relationships of trust and love. The leaders considered exposure to faith as a crucial part of their effectiveness with youth.

Improving academic performance seems to flow more from attending church than from merely believing. That is, the church's social life influences youth from poor communities more than doctrine. In neighborhoods where libraries and schools are often depleted and after-school jobs are hard to find, the church is the main resource-rich presence in the community. For instance, Black churches in Leon County, Florida, have been very supportive and attentive to the needs of the children within their
communities. These churches recognize the unique problems that exist for children residing in their communities and have sought ways to address these problems through grants, corporate sponsorship, and congregational and community support. In an effort to serve the youth in its community, Bethel African Methodist Episcopal (AME) Church was the recipient of a Department of Juvenile Justice grant in 2002 that was used to provide after school services (i.e., mentoring and tutoring) for elementary and middle school children. Many of the mentors for this program were criminal justice students from Florida A&M University. New Mt. Zion AME Church, located in Tallahassee, Florida, in its efforts to provide school supplies for the children in the community, sponsors an annual pack bag program where children are given backpacks filled with the necessary supplies for the new school year. It should be noted that Griffin Middle School, which is located about two-tenths of a mile south of New Mt. Zion AME Church, performed better than other schools located in disadvantaged communities.

**The Black Church: A New Agenda**

Those who would save America's inner-city schools are discovering a long-neglected resource: the Black church. From after-school tutorials to summer schools, computer classes to family science activities, Black churches are renewing their historic commitment to education. But now, they receive money from private foundations and
some government agencies that see Black churches as their best link to children in neighborhoods beset by poverty, violence, and school failure.

As retired Senior Bishop John Hurst Adams of the AME Church observed recently, Black churches are operating essentially on the agenda given to them by their founders. The first agenda of early Black American congregations and of emergent denominations included (a) the proclamation of the gospel, (b) benevolence, (c) education, and by the mid-19th century, (d) foreign missions (Jones, 2001). The fact that these items continue to dominate the church’s mission priorities and stewardship planning may be attributed in part to the continuing marginalization and relative powerlessness of Blacks in American society. It is also due, in part, to the fact that religious institutions in Black communities have not been sufficiently cognizant of the radical implications that the changing political, economic, and social realities have for the lives of their congregants. Bishop Adams’s antidote for this institutional inertia is zero-based mission planning—an imaginative and valid suggestion.

The church’s historic concern for education initially focused on efforts to compensate for the exclusion of Blacks from access to elementary education. After emancipation, the most pressing concern became that of establishing and supporting secondary schools and colleges (Jones, 2001). By 1900, the churches had compiled an impressive record: Black Baptist associations were supporting some eighty elementary
schools and eighteen academies and colleges; the AME churches were underwriting thirty-two secondary and collegiate institutions; and the smaller AME Zion denomination was supporting eight (Jones, 2001).

Historically, the Black Church has been a core institution for African-American philanthropy. The Black Church not only serves as a faith-based house of worship, but also facilitates organized philanthropic efforts including meeting spiritual, psychological, financial, educational, and basic humanitarian needs such as food, housing, and shelter. Most Black churches are community focused, committed to helping the inner city, and are owned and operated by African-Americans (Duran, 2001). Their affect on the Black community, especially as it relates to education, is historically well-documented.

The following examples show ways in which schools have developed collaborative partnerships with churches and other religious organizations:

1. Between 2002 and 2004 there was a 50% increase in number of faith-based organizations receiving state funding to provide juvenile delinquency prevention services in Florida. These services typically involved educational and character development activities. Following the direction of the Federal Government, the leadership in Florida recognized the importance and commitment of faith-based organizations in providing community-based social services and encouraged their
participation. State agencies were encouraged to solicit faith-based and other
nontraditional service providers to compete for grants and other funding sources on an
even playing field with other social service agencies.

2. The University of South Florida, located in Tampa, Florida, has developed a
Church Leaders Assuring Student Success (C.L.A.S.S.) program, designed to promote
the collaboration and sharing of educational resources and information between faith-
based organizations, community groups, and schools.

3. Shiloh Baptist Church in Washington, DC, established a Family Life Center to
strengthen and nurture families in the surrounding community, bringing them together
for educational, cultural, and recreational activities. One of its educational programs is
the Male and Female Youth Enhancement Project, designed to stimulate healthy
lifestyles in African American youths ages 8-15 in the community by providing them
positive role models, socialization activities, and educational enrichment.

4. In Jackson, Tennessee, ten churches have designed a tutoring program in
collaboration with the local school system to serve children residing in public housing
and other neighborhoods. Three nights a week, church buses provide transportation to
church facilities where 250 volunteers work with 350 children, providing assistance in
reading and math. Volunteers from the tutoring program also raise funds to purchase
school supplies and then operate a school supply store that gives school supplies to students prior to the opening of school.

5. The Sixth Episcopal District of the AME Church (Georgia) launched an America Reads Challenge project with emphasis on rural areas. Meeting Our Community in Their Community launched a campaign to provide a home library for every family in several rural areas. The fourth Sunday of each month was declared My New Books Sunday. The project culminated in a special learning and recreational event featuring storytelling, reading aloud, and a time for children to pick out their new books.

Conclusion

Many national religious organizations are committed to being a part of improving the educational opportunities available to children in the communities that are served by their houses of worship. Together, national organizations, their local affiliates, schools, communities, and individuals can make a positive difference in the family’s involvement in education and help improve schools by assisting children to achieve high standards. In today’s world of expanding educational and technological opportunities, it is more important than ever to find effective and efficient ways to move national initiatives to the local, grassroots level because that is where the real action, which helps children learn, takes place.
Recommendations

The following recommendations are made to assist school administrators in low performing schools in building collaborative partnerships with faith-based organizations:

1. Encourage and build collaborations between state and federal agencies responsible for the oversight and delivery of educational services and faith-based institutions.

2. Study the feasibility of creating a faith-based institute to serve as a clearinghouse and training hub for faith-based organizations. The institute would also provide programmatic and management training, specific goal and objective measurement, evaluation, and documentation.

3. Develop strategies to solicit faith-based institutions to use their existing resources (i.e., facility, transportation, etc.) to provide needed educational and social services within their community.

4. Faith-based institutions must make assisting low performing schools a part of their mission work.
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DYNAMIC MODELLING AND CONTROL OF THE OMEGA-3 PARALLEL MANIPULATOR

Folaranmi Collins Adetu, Carl Moore, Ph.D., and Rodney Roberts, Ph.D.

Abstract

Parallel manipulators are widely used in industrial applications due to their rigid structures and ability to perform automated tasks at high speeds. However, because the links on a parallel manipulator are mechanically coupled, solving its kinematics and dynamics equations can be more difficult than for its serial counterpart. Nevertheless, the inverse kinematics and inverse dynamics models are a critical component of a manipulator’s controller. Specifically, a more computationally simple formulation of the inverse kinematics and dynamics is necessary to achieve efficient and fast manipulator control. In this paper, both the inverse kinematics and dynamics equations for the Omega-3, a 3 degree-of-freedom (3-DOF) parallel manipulator, are developed. For the inverse kinematics problem, the concept of loop closure equations is used to simplify the analysis. The virtual work principle is used to create a numerically simple inverse dynamics model. Using the inverse kinematics and dynamics model, a trajectory tracking controller is implemented on the manipulator and the resulting experiments reveal good tracking behavior.

Introduction

Over recent years the interest in parallel manipulators has been on the rise. These manipulators play a vital role not only in industrial automation but other applications as well. For example, there have been studies that suggest the use of parallel manipulators for cardiopulmonary resuscitation (CPR) [1], flight simulators, shakers used in the study of earthquakes [2], and even image-guided orthopedic surgery [3]. These are just a few applications of parallel manipulators. [4, 5] provides an extensive list of other parallel manipulators and their applications. The versatility of the parallel manipulator, as highlighted by some of its applications mentioned previously, is
innately due to its architecture. Parallel manipulators have more than one link directly coupled to the end-effector creating a closed-loop. This closed-loop architecture, allows for a more rigid structure; therefore, the parallel manipulator is quicker, more accurate, more energy efficient [6], and has a higher load carrying-capacity when compared to its serial counterparts.

Although a parallel manipulator possess high dexterity, the presence of its closed-loop structure and passive joints make it difficult to develop an inverse dynamic model, which is essential in creating a model-based control scheme for the manipulator. Several approaches have been proposed in developing an inverse dynamic model, amongst them is the Newton-Euler’s method [7, 8, 9] and the Lagrangian formulation [10, 11, 12, 13]. Both methods require the internal forces and/or constraint equations governing the manipulator to be explicitly defined. Unfortunately, the closed-loop architecture of parallel manipulators results in numerous constraints, therefore, making it computationally laborious to develop the inverse dynamic model using either method mentioned previously. In order to perform dynamic analysis without proficient knowledge of all the internal and constraint forces, another technique known as the principle of virtual work is employed. This method has been applied to the development of inverse dynamic model of the Stewart-Gough manipulator [16], the DELTA manipulator [15], and other special parallel manipulators [17, 18]. When compared to other traditional methods like the Lagrangian formulation, the principle of virtual work technique has been proven to be less computationally intense [14].
In this paper, a computationally simple inverse dynamic model is developed for the Omega-3 parallel robot – a progeny of the DELTA parallel robot [19]. The model is developed using the principle of virtual work, taking advantage of the fact that this technique does not require the explicit knowledge of constraint forces in order to obtain the manipulator’s dynamics. To further reduce the complexity of the dynamic analysis, a simplifying hypothesis [14] is also employed. The opening section of the paper provides an adequate description of the Omega-3 robot. In subsequent sections, the inverse kinematics, Jacobian, and acceleration analysis are discussed. The latter sections focus on the simplifying hypothesis and derivation of the inverse dynamic model. Eventually, using the dynamic model developed, a Proportional-Derivative trajectory tracking controller is incorporated and trajectory tracking results are revealed.

**Description of the OMEGA-3 Parallel Robot**

![Figure 2.1: The Omega-3 parallel manipulator (Courtesy of Force Dimension)](image-url)
Figure (2.1) shows a diagram of the Omega-3 parallel manipulator used in this research. The manipulator’s structure is based on that of the DELTA manipulator developed by Clavel [19]. The Omega-3 is a three degree-of-freedom (3-DOF) manipulator and has three identical kinematic chains, all linked at the triangular traveling plate. Each chain consists of a semi-circular arm actuated by a motor housed at the base of the manipulator and a pair of parallel light-weight rods that connects the semi-circular arms to the triangular traveling plate and the payload. Just like its predecessor (the DELTA manipulator), the Omega-3 kinematic chains are of type RRPaR, where R and Pa represent revolute joint and parallelogram respectively. Only the revolute joints at the base of the device are actuated, all other joints are considered passive. The resulting motion of the manipulator in its workspace is purely translational, due to the presence of its parallel rods which ensure that the orientation of its traveling plates remain parallel to its base.

**Manipulator Kinematics**

The methodology for kinematic analysis of parallel manipulators is quite different when compared to serial manipulators, primarily because of the presence of kinematic chains in parallel manipulators. As mentioned earlier, a computationally simple inverse kinematics model is desired in the control of parallel manipulators. This section details the development of the inverse kinematics model for the Omega-3 manipulator. Refer to table (A.1) for the values of the kinematic parameters associated with the manipulator.
Before beginning the inverse kinematics analysis, certain geometric parameters have to be defined. Figure (3.1) provides an appropriate illustration for all the parameters referred to in this section of the paper. The absolute reference frame \{O\} is located at the center of the circular base of the manipulator, with each \(i^{th}\) chain fixed at an angle \(\phi_i = 2\pi(i-1)/3\), where \(i = 1, 2,\) and 3. The actuated angle located at joint \(A_i\) is defined as \(\theta_i\) and is measured as illustrated in Figure (3.1). Although there have been inverse kinematic models expressed using passive joint angles [20], the kinematic analysis discussed here would only involve actuated joint angles, \(\theta_i\). By leaving out the passive joint angles, a less complicated formulation of the inverse kinematics model can be developed with fewer unknowns to solve for.

![Diagram](image.png)

(a) Front view (not showing parallel arms)  
(b) Side view (showing only one kinematic chain)

Figure 3.1: Front and side view of the Omega-3 manipulator
To solve for the inverse kinematics, the following loop-closure equation is considered:

\[ \overrightarrow{B_iC_i} = \overrightarrow{A_iC_i} - \overrightarrow{A_iB_i} \quad i=1,2,3 \]  

(1)

This loop-closure equation is intentionally selected as a basis for solving the inverse kinematics of the parallel manipulator in question because of its compact form. Other solutions, [20, 21], for the inverse kinematics of the DELTA manipulator use the more general form loop-closure equation below:

\[ \overrightarrow{OP} + \overrightarrow{PC_i} = \overrightarrow{OA_i} + \overrightarrow{A_iB_i} + \overrightarrow{B_iC_i} \quad i=1,2,3 \]  

(2)

Note that equation (1) is a simplified version of (2) and can be derived by simple vector algebraic manipulation of (2). Because the traveling plate is always parallel to the base of the manipulator, the \( i \)th kinematic chain can be translated by a distance \( R=R_A-R_B \). Therefore, allowing frame \( \{C_i\} \) to coincide with the end-effector frame \( \{P\} \), \( \{B_i\} \) becomes \( \{B'_i\} \), and \( \{A_i\} \) becomes \( \{A'_i\} \). This translation simplifies the analysis a great deal without affecting the results as shown in [15]. With this in mind, equation (1) can now be written as:

\[ \overrightarrow{B'_iP} = \overrightarrow{A'_iP} - \overrightarrow{A'_iB'_i} \]  

(3)

Taking the magnitude of equation (3) and squaring both sides the result is:

\[ \| \overrightarrow{B'_iP} \|^2 = \| \overrightarrow{A'_iP} \|^2 + \| \overrightarrow{A'_iB'_i} \|^2 - 2 \overrightarrow{A'_iP} \cdot \overrightarrow{A'_iB'_i} \]  

(4)

where

\[ \| \overrightarrow{B'_iP} \|^2 = L_B^2 \]  

(5)

\[ \| \overrightarrow{A'_iB'_i} \|^2 = L_A^2 \]  

(6)
\[
\overrightarrow{A_i'B_i'} = \begin{bmatrix} L_A \sin \theta_i & 0 & L_A \cos \theta_i \end{bmatrix}^T
\]  
(7)

The vector \( \overrightarrow{A_i'P} \) is defined by equation (8)

\[
\overrightarrow{A_i'P} = \overrightarrow{OP} - \overrightarrow{O^A'ROA_i'}
\]  
(8)

where,

\[
\overrightarrow{O^A'} = \begin{bmatrix} 0 & 0 & R \end{bmatrix}^T,
\]  
(10)

\[
\overrightarrow{OP} = \begin{bmatrix} p_x & p_y & p_z \end{bmatrix}^T
\]  
(11)

The rotational matrix, \( \overrightarrow{O^A'R} \), specifies the orientation of frame \( \{A'_i\} \) relative to the absolute reference frame \( \{O\} \). \( p_x, p_y, \) and \( p_z \) are the end-effector position, and \( R = R_A - R_B \) as defined previously.

With the parameters defined above and the end-effector position, \( p_x, p_y, \) and \( p_z \) known, all three kinematic chains can be solved simultaneously as a system of equations to obtain the actuated angles: \( \theta_1, \theta_2, \) and \( \theta_3. \)

**Jacobian Analysis**

To develop the inverse dynamics of a manipulator, two important parameters are required – the Jacobian matrix, \( J \), and the time derivative of the Jacobian matrix, \( \dot{J} \). These terms can be obtained by analysis of the velocity and acceleration relationship, between the end-effector and the actuated joints of the manipulator.
Both of these relationships are developed in the following sub-sections, beginning with a look at the velocity relationship.

**Velocity**

The relationship between the velocity of the end-effector and the actuated joint velocities of a manipulator is characterized by the Jacobian matrix, $J$. The Jacobian provides a linear mapping between end-effector velocities and joint velocities. The equation below illustrates this relationship:

$$\dot{X} = J\dot{\Theta}$$  \hspace{1cm} (12)

where, $\dot{\Theta}$ is an $m$-dimensional vector of joint rates, $\dot{X}$ is an $n$-dimensional vector of the end-effector velocity, and $J$ is the $n \times m$ Jacobian matrix. In the case of the Omega-3 manipulator, the Jacobian matrix is a $3 \times 3$ square matrix, considering its three actuated angles map on to the three DOF of the end-effector.

Obtaining the Jacobian matrix is more difficult for parallel manipulators because of the structural dependencies they possess. In [22] a numerical approach is used to obtain the Jacobian, however, a closed-form analytic approach is preferred especially if the derivative of the Jacobian is also desired, as in this case. To obtain the Jacobian matrix analytically, the constraint equation (5) is differentiated to obtain a velocity relationship between the end-effector and the actuated joints. The expression is then rearranged in a similar form as equation (12), revealing the Jacobian matrix.
To begin the velocity analysis, the constraint equation below is \( c \) for each \( i \)th leg:

\[
| | B_i' P | |^2 - L_B^2 = 0 \quad \text{for } i = 1, 2, 3
\]

(13)

This constraint can be interpreted physically as meaning the length of the manipulator’s parallel rods are the same for all three kinematic chains. Let the vector \( u_i \) be \( B_i' P \), hence we can rewrite (13) as:

\[
u_i^T \cdot u_i - L_B^2 = 0 \quad \text{for } i = 1, 2, 3
\]

(14)

\( u_i \) is defined by (3) and can be rewritten as:

\[
u_i = \overrightarrow{OP} - O R(\overrightarrow{OA'} - \overrightarrow{A'B'}),
\]

(15)

After making necessary substitutions as defined by (9), (10), and (11) :

\[
u_i = \begin{bmatrix} p_x \\
p_y \\
p_z \end{bmatrix} - \theta_i \begin{bmatrix} 0 \\
0 \\
R \end{bmatrix} + \begin{bmatrix} L_A \sin \theta_i \\
0 \\
L_A \cos \theta_i \end{bmatrix}
\]

(16)

With the constraint equation defined as (14), the time derivative can be taken, which leads to:

\[
u_i^T \dot{u}_i + \dot{
u}_i^T u_i = 0 \quad \text{for } i = 1, 2, 3
\]

(17)

Due to the dot product’s commutative property (17) can be rewritten as

\[
u_i^T \dot{u}_i = 0 \quad \text{for } i = 1, 2, 3
\]

(18)

\( \dot{u}_i \) is given by,
\[ \dot{u}_i = \begin{bmatrix} v_x \\ v_y \\ v_z \end{bmatrix} + o_i R \begin{bmatrix} -L_A \cos \theta_i \\ 0 \\ L_A \sin \theta_i \end{bmatrix} \dot{\Theta} = \dot{X} + b_i \dot{\Theta} \quad i=1,2,3 \quad (19) \]

Equation (19) is multiplied by \( u_i^T \) to give a similar result as (18),

\[ u_i^T \dot{u}_i = u_i^T \dot{X} + u_i^T b_i \dot{\Theta} = 0 \quad (20) \]

where,

\[ b_i = o_i R \begin{bmatrix} -L_A \cos \theta_i \\ 0 \\ L_A \sin \theta_i \end{bmatrix} \quad i=1,2,3 \quad (21) \]

Equation (20) can be written in vector form, with the values for \( i \) as 1, 2, and 3, substituted to obtain the expression below:

\[ \begin{bmatrix} u_1^T \\ u_2^T \\ u_3^T \end{bmatrix} \dot{X} + \begin{bmatrix} u_1^T b_1 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ u_2^T b_2 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ u_3^T b_3 \end{bmatrix} \dot{\Theta} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \quad (22) \]

where \( \dot{\Theta} = \begin{bmatrix} \dot{\theta}_1 \\ \dot{\theta}_2 \\ \dot{\theta}_3 \end{bmatrix} \) is the actuated joint velocities, and \( \dot{X} = \begin{bmatrix} \dot{v}_x \\ \dot{v}_y \\ \dot{v}_z \end{bmatrix} \) is the end-effector velocity. Rearranging equation (22) to look like (12) the Jacobian becomes:

\[ J = \begin{bmatrix} u_1^T \\ u_2^T \\ u_3^T \end{bmatrix}^{-1} \begin{bmatrix} u_1^T b_1 \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ u_2^T b_2 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ u_3^T b_3 \end{bmatrix} \quad (23) \]

From the expression obtained for the Jacobian, a major difference between serial and parallel manipulators is observed. Unlike the Jacobian of serial
manipulators which is only dependent on joint positions, parallel manipulators depend on both joint positions and the end-effector position.

**Acceleration**

Next, an expression for the derivative of the Jacobian matrix, \( \dot{J} \), is derived. In order to calculate the derivative of the Jacobian matrix, the relationship between the manipulator’s joint accelerations and end-effector acceleration is examined. This relationship is expressed in its general form in equation (24) by differentiating (12)

\[
\ddot{X} = J\ddot{\Theta} + \dot{J}\dot{\Theta}
\]

Equation (22) is an explicit form of (12), therefore, the derivative of (22) can be taken to obtain an explicit form of (24). Differentiating (22) and rearranging the equation results in the following:

\[
\begin{bmatrix}
{u_1^T} \\
{u_2^T} \\
{u_3^T}
\end{bmatrix}
\dddot{X} =
\begin{bmatrix}
{\dot{u_1}^T} \\
{\dot{u_2}^T} \\
{\dot{u_3}^T}
\end{bmatrix}
\ddot{X} - K\ddot{\Theta} -
\begin{bmatrix}
{u_1^T}b_1 & 0 & 0 \\
0 & {u_2^T}b_2 & 0 \\
0 & 0 & {u_3^T}b_3
\end{bmatrix}
\dot{\Theta}
\]

where, \( K =
\begin{bmatrix}
{u_1^T}\dot{b}_1 + \dot{u_1}^Tb_1 & 0 & 0 \\
0 & {u_2^T}\dot{b}_2 + \dot{u_2}^Tb_2 & 0 \\
0 & 0 & {u_3^T}\dot{b}_3 + \dot{u_3}^Tb_3
\end{bmatrix}
\)

Further simplification and substituting (12) for \( \ddot{X} \) we get

\[
\dddot{X} =
\begin{bmatrix}
{u_1^T} \\
{u_2^T} \\
{u_3^T}
\end{bmatrix}
^{-1}
\begin{bmatrix}
{\dot{u_1}^T} \\
{\dot{u_2}^T} \\
{\dot{u_3}^T}
\end{bmatrix}
J - K\ddot{\Theta} -
\begin{bmatrix}
{u_1^T} \\
{u_2^T} \\
{u_3^T}
\end{bmatrix}
^{-1}
\begin{bmatrix}
{u_1^T}b_1 & 0 & 0 \\
0 & {u_2^T}b_2 & 0 \\
0 & 0 & {u_3^T}b_3
\end{bmatrix}
\dot{\Theta}
\]
Comparing (26) with (24) we see both equations are similar and it is obvious that, $\dot{J}$, is the term being multiplied by $\dot{\Theta}$. Hence,

$$
\dot{J} = -\begin{bmatrix}
    u_1^T \\
    u_2^T \\
    u_3^T
\end{bmatrix}^{-1}\begin{bmatrix}
    \ddot{u}_1^T \\
    \ddot{u}_2^T \\
    \ddot{u}_3^T
\end{bmatrix} (J - K)
$$  (27)

**Manipulator Dynamics**

For a manipulator with $n$ actuated joints, its rigid body dynamics is governed by the following equation:

$$
\tau = M(\Theta)\ddot{\Theta} + V(\Theta, \dot{\Theta}) + G(\Theta)
$$  (28)

where $M(\Theta)$ is the $n \times n$ mass matrix of the manipulator and a function of the joint position $\Theta$, $V(\Theta, \dot{\Theta})$ is an $n \times 1$ vector of centrifugal and Coriolis terms and a function of both joint position $\Theta$ and joint velocity $\dot{\Theta}$, $G(\Theta)$ is an $n \times 1$ vector of gravity terms and a function of joint position $\Theta$, and $\tau$ is an $n \times 1$ vector of joint torques. Equation (28) is developed in terms of joint space, but it can also be expressed in task-space [23]. Table (A.2) provides the masses of the different members of the Omega-3 manipulator.

*The Principle of Virtual Work*

In order to obtain equation (28) the authors employ the principle of virtual work. The principle states that at equilibrium, the virtual work, $\delta W$, done by all external forces, $F$, acting on a body during any virtual displacement, $\delta r$, consistent
with the constraints imposed on the body is equal to zero. This principle is illustrated mathematically below:

\[ \delta W = \sum_{i=1}^{N} F_i \cdot \delta r_i = 0 \quad (29) \]

In equation (29), only external forces are considered, all internal forces, i.e. constraint and reaction forces are ignored because no virtual work is done by these forces. The virtual work principle is traditionally used to solve static problems. However, for a system that is not at rest, the force (inertia force) as a result of the body’s mass \( m \) accelerating at rate \( a \) is included in (29). This extension of the principle of virtual work for dynamic cases is also known as D’Alembert’s principle \[24\]. Equation (30) is an extension of (29) with the inertia force included:

\[ \delta W = \sum_{i=1}^{N} (F_i - m_i a_i) \cdot \delta r_i = 0 \quad (30) \]

For a rigid body that is capable of both translational and rotational motion equation (30) is generally written as:

\[ \delta W = \sum_{i=1}^{N} [(F_i - m_i a_i) \cdot \delta r_i + (\tau_i - I \ddot{\theta}) \delta \theta] = 0 \quad (31) \]

where \( \tau \) is the external torque acting on the body, \( I \) is the moment of inertia, \( \ddot{\theta} \) the angular acceleration, and \( \delta \theta \) is the virtual angular displacement.

Simplifying Hypothesis
The Omega-3 parallel manipulator, just like its DELTA predecessor, consists of parallelogram rods. These parallelogram members add to the complexity of the dynamic model. However, because these rods are very light and built from an aluminum alloy, it is possible to simplify the dynamic problem by applying similar propositions discussed in [14].

This proposition includes neglecting the rotational inertia of the parallel rods and dividing the masses of the rods into two portions concentrated at the two joint extremities. Therefore, half of the mass of the rods will be centered at the upper extremity (i.e. the joint where the semi-circle member meets the parallel rods), while the other half will be centered at the lower extremity (i.e. the joint where the parallel rods meet the moving triangular platform). With this simplifying hypothesis, the manipulator is reduced to only four members – the three semi-circular arms and the end-effector plate.

Dynamics Analysis

Applying the principle of virtual work and the simplifying hypothesis proposed earlier, the total virtual work done by all external forces acting on the four individual members – the three semi-circular arms and the end-effector – of the Omega-3 manipulator must equal zero. A dynamic analysis for the individual parts of the manipulator is discussed as follows.

The End-Effector
The end-effector portion consists of the travelling plate, the payload, and the concentrated masses of the parallel links. The mass of this portion, $m_E$, is expressed as follows:

$$m_E = m_{\text{PAYLOAD}} + m_p + 3/2m_R$$  \hspace{1cm} (32)

where $m_{\text{PAYLOAD}}$ is the mass of the payload, $m_p$ is the mass of the travelling plate, and $m_R$ is the mass of a pair of parallel rods. Due to the architecture of the Omega-3 manipulator, the orientation of end-effector frame is always parallel to the reference frame $\{O\}$. Therefore, the authors can neglect all terms due to rotational motion in equation (31). The only forces acting on the end-effector are, the force due to gravity $F_G$ and the inertia force $F_A$ due to the acceleration of the end-effector. The principle of virtual work equation for the end-effector can then be written in its vector form as:

$$\langle \vec{F}_G - m_E \vec{a}_E \rangle \delta \vec{r}_E = 0$$  \hspace{1cm} (33)

where $\vec{F}_G = m_E \begin{bmatrix} 0 & 0 & -g \end{bmatrix}^T$, $\vec{a}_E$ is the acceleration vector of the end-effector, and $\vec{r}_E$ is the virtual displacement of the end-effector.

**Semi-Circular Arms**

This member consists of the semi-circular sector and the concentrated point masses of the parallel rods. The motion experienced by this member is purely rotational about joint $A'$. Therefore, all terms due to translational motion in equation (31) are neglected. Three torques act on the semi-circular arms at any point in time;
the torque due to gravity acting on the center of mass $\tau_{CM}$, the torque due to the actuator $\tau_A$, and the torque due to the moment of inertia $I$ about the axis of rotation. The virtual work equation of the semi-circular arm is then expressed as follows:

$$ (\tau_A + \tau_{CM} - I\dot{\theta})\delta\theta = 0 $$

(34)

The next two sections focus on the calculation of the parameters necessary for equation (34).

Torque Due to Gravity

To obtain the torque due to gravity, the center of mass of the composite semi-circular arm, which includes the concentrated point masses of the parallel rods, first has to be calculated. Let $\vec{R}_{CM}$ represent the location of the center of mass relative to the point of rotation $A'$, the center of mass of the composite member is calculated as follows:

$$ m_{SC} \left[ \frac{-4L_A}{3\pi} \ 0 \ 0 \right]^T + 1/2m_R \left[ 0 \ 0 \ L_A \right]^T $$

(35)

where $m_{SC}$ is the mass of the semi-circular sector (without the concentrated parallel rod mass), $1/2m_R$ is the concentrated point mass of the parallel rods, $\left[ \frac{-4L_A}{3\pi} \ 0 \ 0 \right]^T$ and $\left[ 0 \ 0 \ L_A \right]^T$ are vectors describing the location of the mass $m_{SC}$ and $1/2m_R$ respectively, relative to the center of rotation. Taking into consideration the fact that the semi-circular arm rotates about its y-axis by $\theta$, as shown in figure 3.1(b), the
vector $\tilde{R}_{CM}$ has to be rotated accordingly as shown in equation (36) by multiplying it by the rotational matrix $R_y(\theta_i)$
\[
R_y(\theta_i)\tilde{R}_{CM} = \begin{bmatrix}
\cos \theta_i & 0 & \sin \theta_i \\
0 & 1 & 0 \\
-\sin \theta_i & 0 & \cos \theta_i
\end{bmatrix} \begin{bmatrix}
-\frac{4m_{SC}L_A}{3\pi(m_{SC}+1/2m_R)} \\
\frac{1/2m_RL_A}{m_{SC}+1/2m_R} \\
\frac{1/2m_RL_A}{m_{SC}+1/2m_R}
\end{bmatrix}
\]
\[
= \begin{bmatrix}
\frac{-4m_{SC}L_A}{3\pi(m_{SC}+1/2m_R)} \cos \theta_i + \frac{1/2m_RL_A}{m_{SC}+1/2m_R} \sin \theta_i \\
0 \\
\frac{1/2m_RL_A}{m_{SC}+1/2m_R} \cos \theta_i + \frac{1/2m_RL_A}{m_{SC}+1/2m_R} \sin \theta_i
\end{bmatrix}
\]
(36)

Also due to the difference in orientation of the individual semi-circular arms from the reference frame $\{O\}$ by $\phi_i$ as shown in figure 3.1(a). The gravity acting on each semi-circular arm is expressed by multiplying the gravity vector defined in the reference frame by the transpose of the rotation about x-axis by $\phi_i$ as shown.
\[
[R_x(\phi_i)]^T \ddot{g} = \begin{bmatrix}
1 & 0 & 0 \\
0 & \cos \phi_i & \sin \phi_i \\
0 & -\sin \phi_i & \cos \phi_i
\end{bmatrix} \begin{bmatrix}
0 \\
0 \\
-\dot{g}
\end{bmatrix}
\]
\[
= \begin{bmatrix}
0 & -\dot{g} \sin \phi_i & -\dot{g} \cos \phi_i
\end{bmatrix}
\]
(37)

To obtain the torque due to gravity on the semi-circular arms, the cross product of the vectors expressed in (36) and (37) are taking.
\[
\tilde{\tau}_{CM} = R_y(\theta_i)\tilde{R}_{CM} \times [R_x(\phi_i)]^T \ddot{g}
\]
(38)
Equation (38) provides a vector of torques $\tau_{CM}$, but the authors are only concerned with the torque that causes rotation in the $y$-axis of frame $\{Ai\}$. Therefore, after further simplification the torque about the center of rotation is expressed as:

$$\tau_{CM} = \frac{1}{3\pi} g L_A \cos \phi_i \left( -4m_{SC} \cos \theta_i + \frac{3\pi}{2} m_R \sin \theta_i \right)$$

(39)

**Moment of Inertia**

To calculate the moment of inertia of the composite semi-circular arm, the moment of inertia of the semi-circle (without the point mass of the parallel rods) is first calculated. Considering the axis of rotation is not coincident with the center of mass of the semi-circle, the parallel axis theorem is used to calculate the inertia of the semi-circle (excluding the point mass of the rods):

$$I_{SC} = \frac{m_{SC}}{2} L_A^2 + m_{SC} \left( -\frac{4L_A}{3\pi} \right)^2$$

(40)

Adding the moment of inertia of the concentrated point mass of the parallel rods $I_{PR}$, the inertia of the composite semi-circular arm is defined as:

$$I = I_{SC} + I_{PR}$$

$$I = \frac{m_{SC}}{2} L_A^2 + m_{SC} \left( -\frac{4L_A}{3\pi} \right)^2 + \frac{m_R}{2} L_A^2$$

(41)

**Complete Manipulator Dynamics**

With the dynamic parameters for the individual components of the manipulator calculated, the complete manipulator dynamics can now be developed. Recall from equation (31), the sum of all virtual work done on the system by all
external forces and torques must be equal to 0. Therefore, adding equation (33) to (34) and rewriting it in vector form we have

\[
(\vec{F}_G - m_E \vec{a}_E) \delta \vec{r}_E + (\Gamma_A + \Gamma_{CM} - I \vec{\Theta}) \delta \vec{\Theta} = 0
\]  

(42)

where \( \Gamma_A \) is a vector of actuator torques for all three joints \([\tau_{A1}, \tau_{A2}, \tau_{A3}]^T\), \( \Gamma_{CM} \) is the vector of torques due to the gravity for all three semi-circular arms \([\tau_{CM1}, \tau_{CM2}, \tau_{CM3}]^T\), and \( \vec{\Theta} \) is the vector of angular accelerations \([\dddot{\theta}_1, \dddot{\theta}_2, \dddot{\theta}_3]^T\). This equation consists of parameters in both task-space and joint space, in order to obtain a joint space representation, the effects of translational forces acting on the end-effector can be converted to torques acting on rotational joints using the following equation.

\[
\tau = J^T \vec{F}
\]  

(43)

Applying, equation (43) for the translational forces and substituting \( \vec{a}_E \) with (24), equation (42) becomes,

\[
J^T (\vec{F}_G - m_E (J \dot{\vec{\Theta}} + J \ddot{\vec{\Theta}})) \delta \vec{\Theta} + (\Gamma_A + \Gamma_{CM} - I \vec{\Theta}) \delta \vec{\Theta} = 0
\]  

(44)

Dividing through by the virtual displacement \( \delta \vec{\Theta} \)

\[
J^T (\vec{F}_G - m_E (J \dot{\vec{\Theta}} + J \ddot{\vec{\Theta}})) + (\Gamma_A + \Gamma_{CM} - I \vec{\Theta}) = 0
\]  

(46)

further simplification and rearrangement of equation (46) yields

\[
\Gamma_A = (I + J^T m_E J) \dddot{\vec{\Theta}} + J^T m_E J \dddot{\vec{\Theta}} - J^T \vec{F}_G - \Gamma_{CM}
\]  

(47)
comparing equation (47) with (28) the following dynamic parameters can be extracted

\[ M(\Theta) = I + J^T m_E J \]  
\[ V(\Theta, \dot{\Theta}) = J^T m_E \dot{J} \]  
\[ G(\Theta) = -J^T \tilde{F}_G - \Gamma_{CM} \]

\((48)\)  
\((49)\)  
\((50)\)

**Results**

A PD controller is integrated with the inverse dynamic model developed, in order to create a trajectory tracking controller. A circle of radius 0.06m is created as the desired trajectory the robot must follow in task-space. The task-space equations describing the circular trajectory are shown in equation (51).

\[ x = 0.1; \ y = 0.06\cos(\pi t); \ z = 0.06\sin(\pi t) \]  
\((51)\)

The desired task-space trajectory is converted to joint-space and its position and velocity in joint space are shown in figure 6.1(a) and (b). Using the inverse dynamic model in the trajectory tracking controller, figure 6.1(d) shows the position errors begin to converge to zero after about 0.4 sec and the error between the desired trajectory path and actual path of the robot is less than 2mm. Figure 6.1(c) shows the joint errors as it converges also to zero.
Conclusion

In this paper, a computationally simple and compact form of the inverse dynamic model of the Omega-3 parallel manipulator was developed using the principle of virtual work. In order to create this model a simplifying hypothesis proposed in [14] was applied. A simplified solution for the inverse kinematics was also provided by applying the concept of the loop closure equation to the problem. Using the inverse dynamics with a PD controller the authors created a trajectory
tracking controller which provided good tracking results with task-space position errors less than 2\(mm\) of the desired trajectory.

With the compact form of the dynamic model developed in this paper, the authors are able to obtain more accurate trajectory tracking results. Further work will focus on creating a telerobotics interface between the Omega-3 robot and a user controlled robotic manipulator. The authors plan on having the Omega-3 track the trajectory of the user-controlled manipulator. The end-effector of the Omega-3 will be retrofitted with a force sensor that would allow the user on the other end to feel contact forces experienced by the Omega-3 manipulator as it comes in contact with objects its environment.
Appendix A

KINEMATIC AND DYNAMIC PARAMETERS OF THE OMEGA-3 MANIPULATOR

TABLE A.1: Kinematic parameters for the OMEGA-3 Manipulator

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_A$</td>
<td>70.00</td>
</tr>
<tr>
<td>$L_B$</td>
<td>146.00</td>
</tr>
<tr>
<td>$R_A$</td>
<td>75.00</td>
</tr>
<tr>
<td>$R_B$</td>
<td>35.25</td>
</tr>
</tbody>
</table>

TABLE A.2: Masses associated with the OMEGA-3 Manipulator

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$m_{PAYLOAD}$</td>
<td>70.00</td>
</tr>
<tr>
<td>$m_P$</td>
<td>110.00</td>
</tr>
<tr>
<td>$m_R$</td>
<td>34.93</td>
</tr>
<tr>
<td>$m_{SC}$</td>
<td>100.00</td>
</tr>
</tbody>
</table>
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Violence in American Schools

Tony J. Manson, Ph.D.

Introduction

Violence in American schools has increased dramatically, and that violence is often associated with youth gang activity. The more publicly visible and horrifying acts of violence in American high schools and junior high schools this past year are just the tip of the iceberg. Recent figures for the school year 1996-1997 reported 4,000 cases of rape and sexual assault. Additionally, there were also over 11,000 cases of physical assault, including assaults with weapons. This violence correlates, to some extent, with an increase in youth gang violence that has more than doubled during the past two decades (Owens, 1999).

Violence is not limited to large urban school systems. Violence seems to extend throughout the country, affecting all racial, ethnic, and socioeconomic groups. It involves both young men and young women, although young men are more often associated with extreme violence. Much of this violence is related to youth gang activity, or to young gang wannabes. Youth gang membership increased to 650,000 young people by 1995, with gangs located in over 2,000 separate cities (Jackson, 1999).
Gang activity and gang violence have extended to school grounds with activities including harassment, drug-dealing, fighting, intimidation, violence toward teachers, vandalism, assault, and recruitment of young children into gangs (Gaustad, 1990). Obviously, rivalries between gangs and between different school factions affect the public schools and place both students and staff members in increasing danger.

**Causes**

Almost everyone has an opinion about the causes of increased violence. Causes such as violent video games to lack of prayer in the schools are often touted. This paper is a review of several of these proposed causes.

One of the more unusual suggestions, although an interesting one, is that school violence is caused by boredom. Scitovsky (1999) suggested that many young people are bored from lack of sufficiently challenging physical or mental activity. They are unable to release their strong energy in acceptable and appropriate ways and, consequently, turn to violence. According to Scitovsky, the solution is relatively simple; demand that the educational system focus on helping young people develop numerous peaceful leisure activities that are enjoyable, engaging, and energizing enough to be preferred over violent activity. The author noted that violence such as vandalism, assault, and murder are activities that require little skill but are assertive and attract a great deal of attention. This makes these activities satisfying and relieves the perpetrator’s boredom. Children today often have few chores or other activities but a great deal of leisure time.
In some respects, this explanation restates the old saying "Idle hands make the devil's work". However, its age does not mean it is inaccurate.

A unique explanation, dismissed by professionals, was that toxic waste led to the actions of the boys at Columbine High. Some environmentalists noted that there is an extremely high concentration of toxic-waste sites in the area and that these toxins might have caused problems in the boys' mental state. However, EPA and other officials indicated no reasonable link between the contaminants and the behavior (Edwards et al., 1999).

More common explanations, however, have focused on problems of gun availability, media violence, and increased hatred and incivility. For example, Brown (1999) noted that racial hatred should be be considered as a primary cause of many outbreaks of violence in high schools. He noted that it was apparently an element of the situation in the Columbine High School killings, but that it is also linked to other situations while ignored by the media. He indicated that the media would present the public massacres in the schools during the past few years differently if the perpetrators had been young black males rather than young white males. The media has tended to avoid looking at the connection between racial hatred and violent behavior, and certainly has not implied that violence is connected with being Caucasian (although some have noted that the most egregious incidents are connected with males, not with young girls).
The easy availability of weapons of all sorts has been blamed many times. Interestingly enough, there are those who contend that school violence could be lessened by arming teachers, ensuring that they could control any violent students. For the most part, however, the emphasis has been on lessening the access of young people to guns and other dangerous weapons. Congress responded to the Columbine High School massacre by eliminating all new gun-control proposals despite wide-scale public support for some measures. Instead of passing new gun-control legislation, the House chose to respond to the problem by passing a law giving states the right to post the Ten Commandments on public property (Garrett, 1999).

This leads to another explanation of increased high school violence which tends to be the explanation preferred by conservatives. The emphasis is on the decline of morality in the United States, often connected with feminism, mother's working, and lack of prayer in schools. Clearly, most of the politicians, and most of the interest groups, talking about the causes of violence in American high schools are less interested in the real reasons than they are in reinforcing their own ideologies and putting forth their own agendas for cultural change. For liberals, that involves gun control. For conservatives, that includes support of the Christian church, the Ten Commandments, and access to guns. There is little indication of funding research on reasons for the explosion of violence. Everyone already believes they know the reasons.
Consequences

What are the consequences of this kind of political posturing? There will continue to be incidents of the same type until some means of effectively addressing the problem is developed. In the short term, that might mean more security including metal detectors. In the long-term, perhaps a more compassionate interest in American youth that does not serve as a platform for politicking.

As for the consequences of the current level of violence in high schools and high schools activities, the damage is incalculable. Certainly when high percentages of teens report suffering from either physical or sexual assault, or both, there are likely to be long-term effects (Hilton et al., 1998). For young women, the results may include long-term dysfunction in relationships. Ramifications include becoming accustomed to a level of violence within dating relationships that extends into marriage. For young men, the consequences can be as severe as death and, more frequently, physical trauma, emotional trauma from the loss of friends, involvement in violence, schools suspension, long-term problems with obtaining employment, and/or prison.

Possible Solutions

Again, there are many different suggestions regarding possible solutions to the problem. These tend to be related to the causes that people identify as leading to increased violence. For example, the New York Governor George Pataki’s Task Force on School Violence indicated that a common thread in high school violence is a lack of
respect for others, including authority figures and peers. In response, the Task Force proposed that the State Board of Regents in New York develop a special curriculum in civility, citizenship, and character, which would be required and would be taught to students beginning with kindergarten. The Task Force also recommended that schools work more closely with mental health professionals to identify and treat children before they become violent. They noted that alternative punishments and schools need to be available for children identified as out-of-control or having behavior problems (Latham, 1999).

Another tack taken by a large group of people is the need for education about conflict resolution or training in non-violence in high school. Interestingly enough, some research has shown that such training has been counterproductive, leading to negative attitudes rather than changes in behavior. Hilton et al. (1998) provided a knowledge-based intervention to approximately 350 students in the 11th grade. They used measures studying knowledge gained and attitudes toward certain behaviors and peers. What they discovered was that students who attended the anti-violence intervention gained new information without any backlash in attitude. However, students with the least knowledge to begin with were the least likely to attend the intervention sessions, and perpetrators of violence tended to know less than victims and be less likely to attend. Positive effects were not limited to victims. Both perpetrators and victims who attended the intervention did gain knowledge and did
not report negative attitudes or backlash. There was not sufficient follow-up, however, to judge the enduring nature of the favorable effects.

What has seemed to have some effect is the determination by schools to take a zero-tolerance approach toward violence. Essentially this means that there are no warnings for students who engage in violence on school property or bring items to school that can be used as weapons. Instead, the first action results in some sort of disciplinary action. This seems to be more favored by rural schools than urban schools, however, and has the disadvantage of leaving children without alternative forms of education. However, it seems to make a difference in the level of violence in schools and reduces reported incidents of bullying and other forms of student on student harassment (Litke, 1996).

For example, a rural school in Alberta, Canada, developed a problem with violence during a time of community growth and an increase in the student population. A new leadership group took over which seemed to have different values than leaders from the past. These leaders favored intimidation and bullying, while showing little respect for rules. After a number of violent incidents, the school adopted a zero-tolerance policy in which violations would result in automatic suspensions or expulsions. Although students, parents, and some in the community tested the policy, it was fundamentally supported. The author indicated that the basic community support made a difference, and he had several recommendations for schools dealing with
similar violence problems. The author indicated that it was important to be both proactive and multifaceted in dealing with student violence. He suggested an advisory program and awareness of group dynamics. Fundamentally, he noted that the most important thing in the middle of a crisis is to take action, rather than dither and philosophize (Litke, 1996).

This might be a good recommendation for Congress, although unlikely to be heeded. Nonetheless, there are some locales where gun control is viewed as favorable and action taken. Even in Congress, there is movement regarding requiring childproof trigger locks on new handguns and laws to prevent children under 18 from buying semiautomatic weapons or obtaining them from others. However, regulation of gun shows, raising the minimum age for handgun purchase, and various types of background checks remain questionable issues for a Republican-controlled Congress (Garrett, 1999).

Since there are different forms and levels of violence, it is likely that different approaches will be needed to deal with them. Litke's emphasis on a multifaceted, action approach seems useful. Zero-tolerance policies, if linked to alternative school programs, show promise for dealing with troubled students while improving the atmosphere for the majority of their peers.
Bibliography


BUILDING BLOCKS OF PARENT INVOLVEMENT: MODEL DEVELOPMENT

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Introduction

The Florida A&M University Social Work Department and the Florida State University College of Human Sciences, under a grant from the John S. and James L. Knight Foundation, produced a pilot study that explored the family involvement needs in the Tallahassee, Florida, community and, subsequently, used the research findings to build a model for strengthening family participation in the education of preschool children. The researchers recognized that parental participation is linked to helping children succeed in school, and that effects of increased family involvement in the early years of a child’s education will yield higher learning gain scores over time.

Concomitantly, the study carried implications for a major community concern about the lack of school readiness of preschoolers in Tallahassee and, more broadly, Leon County, where the need for children to be better prepared for school is quite prevalent. Key points from an analysis of the community concern relevant to this report from the Florida School Accountability Reports (1998-2008) are:
• Schools on the Southside of the community (e.g., Bond and Wesson Elementary) have consistently performed lower on the Florida Comprehensive Assessment Test (FCAT) than other schools in the county.

• The mean FCAT reading score is 298 for the state of Florida and 318 for Leon County. In comparison, reading scores at Bond and Wesson Elementary Schools are 284 and 265 correspondingly.

• Between 2000 and 2002, school grades for Bond were D, C, and D compared to Wesson’s school grade results of D, C, and F during this same period of time. Further, Bond and Wesson were graded D and C respectively in 2003. As recent as 2008, Bond received a school grade of C.

Based on existing data from the Florida School Availability Reports 1998 to 2008, the variability of these grades suggests that sustained improvement in academic performance has not been achieved. These findings point out that academic progress is not at the level it should be within the Southside area of the Tallahassee community. Of the various efforts required to strengthen academic performance in the children of this community, we have determined that school readiness is one aspect that can be addressed and that can yield impact. Other community efforts are underway to demonstrate the importance of this particular need. For example, a Community Priorities Initiative, under the leadership of the United Way, has identified school readiness as a possible human services priority area for the future. A Community
Conference on Kids was held in late August 2003 to garner community input and direction for this priority. This has led to the formation of the Whole Child Leon Leadership Council.

School readiness is an ongoing issue in American society. Children are entering school without basic school readiness skills—communication, language and literacy, and social skills. According to Starting Points, the 1993 report from the Carnegie Foundation, teachers report that 35% of American kindergarten children arrive at school unprepared to learn. Perhaps even more alarming are the number of children from low income families who are unprepared to begin school. Current data indicate that about 50% of all children from low income families begin the first grade at least two years behind their peers in cognitive, social, and emotional development. Because these delays persist and increase with time, a child’s preschool experiences directly affect school performance.

Family involvement literature relative to children’s development purports there has been increasing alarm and discussion over the past two decades regarding the educational status of children in the United States (Moreno, 2000). Currently, there is an increased number of children reared for some period of their childhood in less than ideal conditions. For example, in the United States, at least one-fourth of children live with one parent, and this parent is without sufficient economic resources. Among African-Americans, this figure increases to more than 55% (Edwards & Young, 1992;
Furthermore, family involvement efforts are challenged by ambiguous definitions of family involvement and the diversity of family-school environments (Coleman & Churchill, 1997). Finally, few specific research-based processes have been identified that facilitate parents’ involvement across diverse populations and community contexts (Moreno, 1999).

Several studies have identified parent involvement as one of various factors which can promote students’ educational success (Gutman & Midgley, 2000; University of North Carolina-Chapel Hill, 2000; The National PTA, 1997). Moreover, the greater the family and community involvement in schools, the greater the students’ achievement (Niemiec, Sikorski & Walberg, 1999). For these reasons, development of the family involvement model has the major purpose of improving the cognitive and social skills of preschool children who reside in the southside of Tallahassee. The broader impact envisioned is that these children, who will eventually attend Wesson, Bond, or other Southside schools, will have enhanced academic performance in elementary, middle, and high school as a result of getting a good start in preschool. Second, this project will affect the students themselves as they select careers for the future. And finally, this project will have implications for a family involvement model at the national level with modifications made based on the diverse characteristics within a parent population throughout the country.
One problem with unsuccessful family involvement strategies is that they often spring from program planners who are not sufficiently aware of the actual needs and desires of the families they wish to serve. The authors wanted to develop a model that takes full advantage of this community’s knowledge. To this end, the authors employed a community needs assessment process (using focus groups) that allowed them to explore the expertise of child care providers in the community who have gained valuable expertise in the area of increasing and maintaining family involvement. The goal was to gain as much practical and community-specific information as possible about building vital, lasting, and well-informed partnerships with families.

Objective

This pilot study explored the family involvement needs in the Tallahassee community with an eye toward identifying the current best evidence to inform the design of a conceptual model for increasing parents’ participation in their children’s early education. Presenting such a model is the primary goal of this report.

Methodology

Under the collaborative efforts of research investigators from the Florida A&M University (FAMU) Social Work Department and the Florida State University (FSU) College of Human Sciences, the national literature on successful family involvement programs was examined and a qualitative study was conducted using focus group interviews as a research methodology.
The authors partnered with Jumpstart, a national non-profit service organization, to create a data-base of research findings and to develop the model for strengthening family involvement. The College of Human Sciences at FSU has been a Jumpstart host site since 2002-03. Founded in 1993, Jumpstart’s mission is to engage young people in service to prepare children for success in school. Jumpstart pairs college students with preschool children (struggling in Head Start and other early education classrooms) for the purpose of focusing on the development of the child, his or her family, and the college students serving as AmeriCorps members. This organization was particularly valuable as a test site and research step after the focus groups identified the most salient issues pertaining to family involvement from the parents and teachers’ perspectives.

The research team began the initial phase of inquiry by developing the following questions for the focus group interviews:

1. What are your thoughts about connecting with your children’s teachers?
2. What problems are associated with greater parental involvement?
3. What are some aids that would be helpful in improving parental involvement?
4. What barriers might lead to less parent involvement?
5. What resources are necessary for encouraging active parental involvement?
6. What are some successful strategies for increasing parental involvement?
The authors recruited parents, teachers, and administrators who served in three separate Leon County Head Start Centers and the FAMU New Beginnings Childcare Center as well as FSU Jumpstart members to participate in the focus groups. From those recruited, six focus groups were planned and participation was facilitated among the target stakeholders (6–8 participants per group) and covered target groups, including:

- One focus group with teachers who were in at least in their second year playing host to Jumpstart students in their center and classroom.
- One focus group made primarily of teachers who were in their first year of hosting Jumpstart students in their center and classroom.
- One focus group of Jumpstart parents who had their child in the Jumpstart program for at least one full year.
- One focus group of Jumpstart parents new to the program.
- One focus group with veteran Jumpstart corps members in at least their second year of service in the program.
- One focus group with new Jumpstart corps members who had recently completed their Jumpstart training and had just started in their relationships with their target child and his/her family.

Driven by the purpose of the study, an analysis of the focus group results was completed. Detailed transcripts of audio recordings generated verbatim records of
spontaneous interactions within the groups. A trend analysis was compiled from the qualitative inquiry. Data from every group was coded by thematic headings, including illustrative quotations that gave clear examples under each category.

Extensive interviews with members of the child development community in the Big Bend area was another source of data that provided detailed illustrations of successful strategies for overcoming barriers to parent involvement.

During this phase of the project, the authors examined the knowledge gained from the local inquiry and analyzed it from the standpoint of the national literature on successful family involvement strategies. The aim was to determine how these successful strategies might be best implemented given the specific needs of the Southside community.

Finally, a Town Hall meeting was the culmination of this process. The authors personally invited parents, licensed teachers, and child care administrators from over 300 centers in the Big Bend area to present the completed model.

**Results**

As a direct result of this project, the authors have endeavored to present a model which highlights the essential building blocks of strong parental involvement. The term *parent* in this model and discussion refers to both biological parents and other family caregivers such as grandparents, step-parents, and extended family members who have a nurturing role in the life of the child.
Our model, as proposed by Dr. Steven Mills at FSU, is a variation of the model initially introduced by Hoover-Dempsey and Sandler (1995 and 1997) and later revised by Walker, et al. in 2005. The authors’ version is informed by local research efforts and the latest literature on family involvement in early childhood education. The following is a brief description of each of the model components or building blocks of parent involvement (see page 6 for model diagram):

Parents’ Motivational Beliefs

Parents’ Motivational Beliefs are determined by the beliefs parents hold about their role in their child’s education and their confidence in their ability to fulfill this role.

Parent Role Beliefs

The parents interviewed ranked their responsibility for their children’s learning outcomes as equal to their responsibility for their child’s moral development. Educators of young children cannot stress the importance of parental involvement enough and do so through written materials to parents, parent conferences, and early literacy after-school programs aimed at the Center parents.

Parent Confidence

Parent role beliefs are not all that is required for sufficient parent motivation to become involved in their child’s education. Parents must also have some degree of confidence in their ability to be effective in this arena. In a nationally representative sample of 2,017 parents with children from birth to three, over half said they wanted
specific information on how to encourage learning (Weiss, Caspe & Lopez (2006). The parents interviewed were no exception to this. They expressed a desire for more specific information on how they can assist in their children’s educational process even saying that often they are not sure how to be effective in this area.

As mentioned above, providing early literacy activities/stimulation is only one way that parents positively affect their children’s literacy gains. Another is by providing a nurturing parent-child relationship. A warm and emotionally safe parent-child relationship with few life stresses is associated with social competence, better communication skills, and an ability to concentrate (Young, Davis, Schoen, & Parker, 1998). Parent confidence is directly related to how competent parents feel in their guidance and disciplinary roles.

Explicit/Implicit Invitation for Involvement

Explicit/Implicit Invitation for Involvement is the second building block of the model. Although the teachers interviewed felt their invitations to parents to become involved in their child’s education were loud and clear, a few parents from these same centers were still unsure how they might become more effectively involved in their young child’s education. Other parents expressed regret that their extensive work schedules did not allow them to actually help in the classroom or attend after-hours events, and were not sure how they might be able to help from home. These parents were relieved to hear that simply talking to their children about their time in school and
displaying a positive, supportive attitude toward their child’s center was a legitimate form of parent involvement.

Regarding implicit invitations to parents to become involved, both the literature and focus group experience emphasizes the utter importance of warm, relational parent-teacher communication whenever possible. Forming relationships with the parents that allow teachers to understand their goals and limitations is a crucial part of this puzzle. The authors discovered, for instance, that parents were very excited about a simple biographical sheet with picture that the Jumpstart corps members sent home at the beginning of the school year. The parents saw this as an implicit invitation to form a partnership with the corps member in the education of their child. Another component of successful programs that offers both an implicit and an explicit invitation to parent involvement is the presence of a dedicated family involvement staff person, either at the center or the program level. Having a person whose job is to coordinate parent efforts and keep the organization mindful of the needs of parents sends a clear message to parents regarding their importance.

*Parent Time/Energy vs. Family Benefit*

Needless to say, the parents we talked with were overwhelmed with their time constraints. Many of them were balancing more than one job with furthering their own education and/or training. They felt guilty about not having more time to spend at their child’s school or even in educational activities in their home. For this reason, successful
family involvement strategies must offer families tangible benefits associated with their involvement. One of the most powerful incentives to young families is the sense of community that child development programs can provide. One theme that echoes through the literature and conversations with teachers, corps members, and parents alike is the need for center teachers and administrators to demonstrate genuine care about the child and family as people, aside from their educational needs.

**Diagram** _Essential Building Blocks of Parent Involvement: Model Development_

**Conclusion**

With regard to increasing the benefit of family involvement as an influence on the academic success of preschool children, research on all levels emphasizes the importance of developing personal relationships with parents where they feel genuinely known beyond their child’s educational needs. In short, when parents have a connection with the *people* who educate their children, they are more likely to get
involved as partners in the education effort. A strong sense of connection and community is a tangible benefit in today’s society.

What emerged from this study is a model which holds that when parents have the right motivational beliefs, feel invited to become involved in their young child’s education, and believe that the benefit of involvement outweighs the sacrifice, they will lend considerable influence to their child’s educational experience. With these building blocks in place, parents are more likely to participate in the three areas of involvement known to affect early childhood literacy – parenting, home-school involvement, and literacy activities (Weiss, Caspe, and Lopez 2006).
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Additional Resources

http://www.cssp.org/doris_duke/index.html. The contact person for this organization is Milliford Ashan (773) 276 - 4213

http://www.gse.harvard.edu/hfrp/projects/fine/resources/research/earlychildhood.html

The Role of Acculturation on Health Behaviors of Elderly African-American Women

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Abstract

Significance and Background: The population of African-American women age 65 and older is on the rise and, despite the notable progress in the nation’s overall health disparities, the burden of illness and death experienced by racial and ethnic minorities persists.

Purpose: Therefore, the purpose of this research is to explore the roles of acculturation on health behaviors of elderly African-American women.

Conceptual Framework: According to Healthy People 2010, individual health is closely linked to the health of the community and environment in which individuals live. Consequently, community health is profoundly affected by collective beliefs, attitudes, and behaviors of everyone who lives in the community. Therefore, Pender’s Revised Health Promotion Model guided this research study.

Methods and Analysis: This study used a descriptive cross-sectional correlational design in the southeastern United States. Two hundred and one (N = 201) participants completed the 47-item African American Acculturation Scale-Revised and the 52-item Health-Promoting Lifestyle Profile II and the 11-item Demographic Health
Survey developed by the researcher. In order to control for Type II Errors the level of significance for this study was 0.5. Data was analyzed using the Statistical Package for Social Sciences Version 15.0 (SPSS). Pearson’s Product-Moment Correlational Coefficient and Bivariate Linear Regression Analysis of were used to analyze the study variables.

**Findings and Implications:** Study findings revealed that older African-American women who reported that they were acculturated towards the dominant society had a significantly higher score on the African American Acculturation Scale Revised and were more apt to practice positive health behaviors. Additionally, findings suggest that there is a need for future research studies on health promotion initiatives that address culture for the development of culturally appropriate activities for older African-American women. Incorporating basic courses on aging with specific content on normal aging, cultural competence, and sensitivity in nursing curricula on all levels is of the utmost importance for professionals working with the elderly, specifically those elders from different ethnic groups.

*Keywords:* acculturation; health behaviors; African-American; women

**Introduction**

Acculturation, which initially captured the interest of the anthropological community, is undoubtedly a core construct in social and behavioral research that describes both nature and effects of interactions within ethnic groups (Whaley, 2001).
Health promotion has gained a global priority over the past two decades with the advent of Healthy People Initiatives, and health care disparities have been addressed by social and political initiative but remain a serious problem in current society. African American women are deeply affected by factors such as poverty, discrimination, limited health coverage, and access to quality health care all of which ultimately affect their overall health status and longevity (Wykle & Kaskel, 1995). Disparities in health status persist and negative health behaviors continue to be the culprits for high morbidity and mortality rates among elderly African-American women. These women find it difficult to change their unhealthy behaviors because of their rich cultural and traditional values (Jennings-Sanders, 2003).

There is a paucity of literature on health behaviors of elderly African-American women (Foster, 1992; Ahijevych & Bernhard, 1994; Taylor, 1995; Kim, Bramlett, Wright, & Poon, 1998; Johnson, 2002). It is well documented in the literature that acculturation plays a vital role in determining whether Asians (Yi, 1998; Juon, Seo, & Kim; 2002; Honda, 2004) and Hispanics (Suarez, 1994; Gonzalez, Haan, & Ladson, 2001; Hulme et al. 2003) engage in health-promoting behaviors; however, only a small number of studies have reported how acculturation impact African Americans, particularly African-American women (Nyamathi et al., 1993; Hines, Snowden, & Graves, 1998; Klonoff & Landrine, 2000; Reid, 2000; Mills & Henretta, 2001; Hargreaves, Schlundt, & Buchowski, 2002; Webb, Looby, & Fults-McMurtery, 2004).
More knowledge on the role of acculturation on health behaviors of elderly African-American women can be used to develop educational and cultural approaches to promote quality and longevity of a healthy lifestyle by using available health services to eliminate health care disparities among African Americans, particularly elderly African-American women.

**Theoretical Framework of Healthy Behaviors**

Pender’s latest version of the Health Promotion Model (HPM) (1996) incorporates expectancy-value theory and social-cognitive theory as well as retaining constructs from Becker’s 1974 modified Health Belief Model. Additionally, the 1996 version of the Health Promotion Model was used for the conceptual underpinning of this study of acculturation, health conception, and health-promoting behaviors of older African-American women in the southeastern United States.

Three major categories are outlined by Pender (1996). They include: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcome. Under the domain of individual characteristics and experiences are prior related behaviors and personal factors including biologic, physiologic and sociocultural. Prior related behavior and personal factors each affect health-promoting behavior directly and also indirectly through behavior-specific cognitions and affect.

The behavior specific cognitions are the portion of the Health Promotion Model that is closely associated with the Health Belief Model. These components include
perceived benefits of the health promoting behavior, perceived barriers to performing the behavior, perceived self-efficacy to carry out the behavior, and activity related affect. These four factors build on one another and lead to a commitment of a plan of action toward health-promoting behaviors.

The affect portion of the model consists of interpersonal influences and situational influences. Interpersonal influences are “cognitions concerning the behaviors, beliefs, or attitudes of others” (Pender, 1996, p. 70). Situational influences include factors like options, demand characteristics and aesthetics and can “facilitate or impede behavior” (p. 71). The affect variables can lead either to a commitment to a plan of action or directly to the health promoting behavior.

The last category in the model, the behavioral outcome, includes a commitment to a plan of action which leads to carrying out the health-promoting behavior. One of the variables added to the Health Promotion Model in the latest revision is immediate competing demands and preferences. Pender (1996) describes this variable as the “alternate behaviors that intrude into consciousness as possible courses of action immediately prior to the intended occurrence of a planned health promoting behavior” (p. 72). Competing demands and preferences can directly affect whether, or how quickly a person adopts the health-promoting behavior. Health-promoting behaviors are the end result, and are directed towards attaining positive health outcomes for individuals throughout the life span (Pender, 1996).
Purpose and Hypotheses

The purpose of this study was to use the revised HPM to examine the role of acculturation on healthy behaviors of elderly African-American women in the Big Bend area of northwest Florida. The study focused on acculturation and health behaviors of elderly African-American women as evidenced by health-promoting behaviors, health screenings, and predictors of those behaviors. Study findings added to the knowledge of cultural factors that influence health behaviors in this vulnerable population of elderly women. This knowledge can be used to develop culturally sensitive approaches to affect the health outcomes of elderly African-American women, which could decrease exacerbation of diseases and ultimately eliminate health care disparities. Two research hypotheses were generated.

1. There is a relationship between acculturation and health behaviors of elderly African-American women.

2. Acculturation scores will be higher on the AAAS-R and will predict healthy behaviors of elderly African-American women.

Design

This is a descriptive cross-sectional correlational research design. There was no intervention or control group used and, since data were collected at one point in time, no causal relationships can be derived. However, the study design can determine many
variable associations to be made while employing statistical controls. Acculturation is the independent variable and health behaviors are the dependent variable.

**Sample**

A purposive convenience sample of 251 participants was recruited from four counties in the Big Bend area of northwest Florida. Based on a power of .80, an effect size of 0.2 (small), and a .05 level of significance two tailed, \((N = 192)\) participants were needed for this study (Stevens, 2002). The Statistical Package for Social Sciences (SPSS) Version 15.0 was used to randomly select 80% of the sample, for a total sample population of \(N = 201\). The remaining 50 participants were used to analyze psychometric properties of the AAAS-R and HPLP II. The study sites were community centers located in rural and urban counties serving predominantly elderly African-American women. Participants who identified themselves as African-American were invited to participate in the study. Inclusion criteria for participation in this study were: age 65 and older, English speaking, community dwelling or non-institutionalized, and cognitive and decision-making capabilities.

**Methods**

**Measures**

Participants were allotted sixty minutes to complete the AAAS-R, HPLP II, and a Demographic Health Survey respectively. Both psychometric instruments and the Demographic Health Survey were on a fourth grade to sixth grade reading level.
The African American Acculturation Scale - Revised (AAAS-R) is a 47-item questionnaire that uses a Likert scale format ranging from 1 (“I totally disagree, not true at all”) to 7 (“I strongly agree, absolutely true”) (Klonoff & Landrine, 2000). A total of 520 African-American adults; 277 women and 243 men, ages 18 to 79, were asked to respond anonymously to the original 74-item African American Acculturation Scale (AAAS) (Landrine & Klonoff, 1994). In order to improve the AAAS, items that respondents found objectionable were dropped. Eight subscales emerged and make up the AAAS-R: religious beliefs and practices, preferences for things African American, interracial attitudes, family practices, health beliefs and practices, cultural superstitions, racial segregation, and family values. High scores on the subscales suggest traditional cultural orientation or immersed in African American culture whereas low scores on the subscales suggest an acculturated orientation or minimal immersion in African American culture (Klonoff & Landrine, 2000). For the purposes of this study the Likert scale ranged from 1 (“I strongly agree, absolutely true”) to 7 (“I strongly disagree, not true at all”). Therefore, high scores on the AAAS-R total and subscales suggested acculturation submerged into the dominant society and low scores represented the traditional African American cultural orientation. The internal consistency for the AAAS-R (N = 520) measures with the following Cronbach’s alpha coefficients: total scale .93; religious beliefs and practices (items 1 – 10) .89; preferences for things African American (items 11 – 19) .89; interracial attitudes (items 20 – 26) .87; family practices
(items 27 – 30) .79; health beliefs and practices (items 31 – 35) .77; cultural superstitions (items 36 – 39) .76; racial segregation (items 40 – 43) .76; and family values (items 44 – 47) .67. The Cronbach’s alpha coefficients for this study (N = 201) were: religious beliefs and practices .81; preferences for things African American .70; interracial attitudes .89; family practices .78; health beliefs and practices .80; cultural superstitions .29; racial segregation .16; family values .66; and total scale .90.

The Health-Promoting Lifestyle Profile II is a 52-item summated behavior rating scale that also employs a 4-point Likert scale format (1=never, 2=sometimes, 3=often, 4=routinely) to measure the frequency of self-reported health-promoting behaviors (Walker, Sechrist & Pender, 1992). The HPLP II consists of six subscales, which include: health responsibility (9 questions); physical activity (8 questions); nutrition (9 questions); spiritual growth (9 questions); interpersonal relations (9 questions); and stress management (8 questions). Health-promoting behavior is conceptualized as a multidimensional pattern of self-initiated actions and perceptions that serve to maintain or enhance the level of wellness, self-actualization, and fulfillment of an individual (Walker, Sechrist & Pender, 1992). The internal consistency for the HPLP II is as follows: health responsibility (.861), physical activity (.85), nutrition (.80), spiritual growth (.86), interpersonal relations (.87) and stress management (.79) and the total HPLP II (.94) (Walker, Sechrist & Pender, 1992). The internal consistency of the HPLP II for this research study was as follows: health responsibility (.64), physical activity (.92),
nutrition (.75), spiritual growth (.69), interpersonal relations (.82), stress management (.62), and the total HPLP II (.91).

The Demographic Health Survey asks participants to identify their country of origin/birth, their age, educational attainment, marital status, and religion.

Prior to data collection, approval from Southern University and Agricultural and Mechanical College Institutional Review Board was obtained to conduct the study. The research instruments were administered to the participants as a part of senior day activities at the various community centers in the four counties of Leon, Gadsden, Jefferson, and Wakulla counties. At the time of the study, the author was a doctoral candidate at Southern University and Agricultural and Mechanical College. Informed consent forms were signed by the study participants. Four research assistants were trained by the principal investigator to explain the informed consent, provide assistance in completing the questionnaires, answer any questions that the participants had, and debrief participants upon completion of the research instruments in order to prevent sharing and discussing questions and responses.

Participants who were able to read and write were asked to complete the AAAS-R, HPLP II, and a Demographic Health Survey. If the participant could not read and/or write, the research assistants read the research instruments to her and filled out her responses.
Analysis of Data

SPSS (version 15.0) was used to analyze data. Descriptive statistics, specifically frequencies, were used to ensure that there was no missing data; percentages were used to describe the demographic data of the sample.

To establish which variables would be used in analyses, Pearson’s Product-Moment Correlation Coefficient was used to examine the correlation between acculturation and healthy behaviors; the AAAS-R subscales and the HPLP II subscales; and the selected demographic variables (age and educational attainment) and AAAS-R total and subscales and HPLP II total and subscales. The One-Way Analysis of Variance (ANOVA) was used to examine the differences between groups of the selected demographic variables (age, educational attainment, and socioeconomic status/type of health insurance coverage) and healthy behaviors. Linear regression was used to determine if acculturation toward the dominant society predicted healthy behaviors and if the individual AAAS-R subscales predicted healthy behaviors. A stepwise regression was also used to determine which predictors from the AAAS-R predicted healthy behaviors. A significance level of $p < .05$ was accepted as significant.

Results

The ages of the elderly African-American women in this study ranged from 65 to 102 years old and the sample was further divided into three age groups: the young-old, ages 65 to 74, 61.7% ($n = 124$); the old, ages 75 to 84, 25.4% ($n = 51$) and old-old, ages 85
and older, 12.9% \((n = 26)\). Thirty-four percent \((n = 69)\) of the study participants graduated from high school or had some high school education; 27.4% \((n = 55)\) completed the eighth grade or less; 19.4% \((n = 39)\) had four years of college; 11.4% \((n = 23)\) had some college; and 7.5% \((n = 15)\) had five or more years of college.

Socioeconomic status was measured by the type of health insurance coverage and 66.7% \((n = 134)\) had Medicare health coverage; 14.5% \((n = 29)\) had some type of major medical insurance; 10.8% \((n = 22)\) had Medicaid health coverage; and 8% \((n = 16)\) had no health insurance coverage.

There was a positive correlation coefficient between acculturation total AAAS-R and healthy behaviors the total HPLP II, \(r(199) = .37, p < .001\). Table 1 illustrates significant positive correlation coefficients between acculturation (AAAS-R subscales) and health behaviors (HPLP II subscales). AAAS-R subscales predicted health behaviors of these study participants: religion, \(r(199) = .25, R^2 = .06, p < .001\); preference things African American, \(r(199) = .35, R^2 = .12, p < .001\); interracial attitudes, \(r(199) = .37, R^2 = .14, p < .001\); family practices, \(r(199) = .26, R^2 = .06, p < .001\); health beliefs and practices, \(r(199) = .35, R^2 = .12, p < .001\); racial segregation, \(r(199) = .16, R^2 = .03, p < .05\); and family values \(r(199) = .16, R^2 = .03, p < .05\). Cultural superstition, \(r(199) = .08, R^2 = .01, p = .25\) did not predict health behaviors of the elderly African-American women in this study. Stepwise regression determined four of the eight AAAS-R subscales (interracial attitudes, preference things African American, racial segregation,
and health beliefs and practices) best predicted health behaviors among elderly African-American women in this study, \( R^2 = .22, F(3,197) = 17.94, p < .05 \).

**Discussion**

Elderly African-American women in this study who reported that they were acculturated towards the dominant society were more apt to take responsibility of their health by engaging in healthy behaviors, good nutritional habits, regular physical activity, looking forward to the future, and stress management. Moreover, acculturation as well as all of the eight AAA-R subscales except cultural superstitions submerged in the dominant society predicted health behaviors among older African-American women. However, interracial attitudes, preferences for things African-American, racial segregation, and health beliefs and practices were the best minimum data set needed to predict health behaviors among older African-American women in this study.

Similarly, Hulme et al. (2003) suggest that acculturation plays a vital role in health behaviors of elderly African-American women as does perceived health status, age, gender, and socioeconomic status. Thus the acculturation factors must be taken into account in order to promote the health of elderly African American women. However, these findings contradicted Reid (2000) study findings that acculturation is not correlated with health seeking or health-promoting behaviors.
Limitation of the Study

The sample was comprised of a purposive convenience sample of older African-American women residing in the southeastern United States. Consequently, this study is not generalizeable to all older African-American women.

Additionally, the inadequate internal consistency of the subscales of the AAAS-R, particularly, cultural superstitions (.29) and racial segregation (.16), and family values (.66) denoted instability within the AAAS-R in that the Cronbach’s alpha coefficient was less than .75. There were also three HPLP II subscales: health responsibility (.64), spiritual growth (.69), and stress management (.62) that had Cronbach’s alpha coefficients less than .75, suggesting measurement instability in the HPLP II.

Nursing Implications

Nursing implications of this research study involved nursing practice, education, and health policy. In education, findings from this study imply the need for nurses to educate elderly African-American women on the importance of taking responsibility for their health by knowing what to ask their providers and ensuring that they are getting the basic preventive health screening tests done as recommended by the national guidelines.
Nursing education should include basic courses on aging and cultural competence in baccalaureate programs with specific content on normal aging, principles of patient education, and adult pedagogy.

Many older African-American women rely on governmental agencies for their health maintenance, nutrition, and community socialization. Therefore, this study has strong implications for health policy directed at sustaining and maintaining programs like Title VII programs whose purpose is to provide at least one nutritionally sound meal daily and facilitate congregate dining in order to foster social contact and relationships. Attention also needs to be given to expanding Medicare services for older African-American women with aims at improving health responsibility by including health-promoting activities.

**Recommendations for Future Research**

The current design and implementation of many health promotion interventions for older adult African-American women have been inadequate (United States Department of Health and Human Services, 2002). Health promotion strategies continue to target the white middle class of all age groups. Therefore, future research studies on health promotion initiatives that address culture are needed for the development of culturally appropriate interventions. Furthermore, there is a need for more nursing research, both qualitative and quantitative, to explore the effects of acculturation and its affect on health behaviors differentiating within homogeneous groups based on socioeconomic status, gender, ethnicity, and age.

Empirical testing of the Revised Health Promotion Model is needed to examine other cultural attributes such as interpersonal influences that are linked to health-
promoting behaviors and disease prevention. Additionally, empirically testing the Health Promotion Model is needed to obtain more knowledge about how variables predict health behaviors among different ethnic groups and between ethnic groups.

Research is also needed to examine the acculturation of older, foreign born African-American women and how acculturation affects health behaviors among this population. Qualitative studies are needed to generate new theory and to determine whether adherence to more traditional cultural values are preserved throughout life or whether this adherence symbolizes resurgence as a means of coping with the demands of aging, i.e., their lived experience.

This research study demonstrated that researchers must incorporate acculturation with population differences that are specific to ethnicity, age, and socioeconomic status in order to deal with population heterogeneity. Failing to recognize these differences may result in misrepresentation of the participants and decreased generalizability of the results. Therefore, attention must be given to the demographic characteristics of the population used to establish psychometric properties that will enable better application and adaptation of the instrument with new populations. Also, culturally and age-sensitive psychometric instruments need to be developed in order to adequately measure the constructs of acculturation and health behaviors.
References


Hulme, P.A., Walker, S.N., Effle, K.J., Jorgensen, L., McGowan, M.G., Nelson,


Table 1
*Correlations Between the AAAS-R Subscales and the HPLP II Subscales*

<table>
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<tr>
<th>HPLP Subscales</th>
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<th>Physical activity Subscale</th>
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<th>Spiritual growth Subscale</th>
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* p < .05. **p < .01. ***p < .001.
APPENDICES
Appendix A

1st Annual University Research Summit
College of Pharmacy and Pharmaceutical Sciences Building
March 26 – 27, 2009

Theme: “Building Research Capacity through Collaboration”

Dean Henry Lewis, Presiding
College of Pharmacy and Pharmaceutical Sciences
Florida A&M University

Thursday, March 26, 2009

7:30 a.m. – 8:20 a.m. ................................................................. Registration
Continental Breakfast
2nd Floor Student Lounge

8:30 a.m. – 9:45 a.m. ................................................................. Plenary Session One
Room 104

Welcome.................................................................................. Chanta Haywood, Ph.D.
Dean, College of Graduate Studies

Keynote Speaker ...................................................................... G. Dale Wesson, Ph.D.
Interim Vice President
Division of Sponsored Research

9:45 a.m. – 10:00 a.m. ................................................................. Video Presentation

“A Capsule View: Research at Florida A&M University”
# MORNING BREAK-OUT SESSIONS

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<th>Time</th>
<th>Title of Presentation</th>
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<tr>
<td>Room 209</td>
<td>10:15am – 10:45am</td>
<td>Moving From A Culture of Teaching to a Culture of Learning</td>
<td>Jennifer Collins, Amos Bradford and Shawnta Friday-Stroud</td>
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<td>10:50am – 11:20am</td>
<td>Assessing Teachers’ Concerns About Block Scheduling</td>
<td>Warren Hope and Rose Campbell</td>
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<td>12:00pm – 12:30pm</td>
<td>The Mathematics of Financial Derivatives and the Fall of Wall Street</td>
<td>Roselyn Williams</td>
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**Group I**

| Room 210 | 10:15am – 10:45am | Prostate Cancer Treatment Patterns among Racial/Ethical Groups in Florida               | Hong Xiao, Cynthia Warrick and Youjie Huang  |
|          | 10:50am – 11:20am | Nathaniel Johnson                                                                       |                                              |
|          | 11:25am – 11:55am | Pest Management in Organic Vegetable production: How Can the Use of Biological Control Be Enhanced? | Haseeb M., Kairo MTK                        |
|          | 12:00pm – 12:30pm | Expressed Coping Strategies And Techniques Among African Families In North Florida Who Are Living With Chronic Hypertensive Cardiovascular Disease | Lisa Lang                                    |
Group III

Room 211 10:15am – 10:45am Revegetation with Native Species Following Mechanical Chemical Control of Cogongrass

Oghenekome Onokpise, Susan Bambo and James Muchovej

10:50am – 11:20am Mosquitocial Potential of Bacillus Cereus

Sabrina Hayes

11:25am – 11:55am High Stakes Testing the Good and the Bad

Ada Burnette

12:00pm – 12:30pm Development and Evaluation of Halophytes as potential Biofuels Feedstock for the Production of Alternate Fuels for Army and Commercial Aviation

Clifford L

Group IV

Room 213 10:15am – 10:45am Effects of FAMU Graduates on Pupil Learning in K-12 Education: A Value Added Analysis

Colin Anderson

10:50am – 11:20am Social Work

Brenda Jarmon

11:25am – 11:55am The Propensity for Land Use conversion: the Case of Forest Property Owners and Corn Commodity Prices in Florida

Nishita Pancholy and Michael Thomas

12:00pm – 12:30pm Renewable Resources and Environmental Stewardship (Poster Presentation)

Rolle, K.A., M.A., Gitau and Chen
LUNCH

12:40 p.m. – 1:10 p.m. ............................................................. Grand Ballroom for Lunch

Plenary Session Two

Dr. Ralph Turner, Ph.D. Presiding
Dean, College of Arts and Sciences
Florida A&M University

1:10 p.m. – 1:55 p.m. ............................................................. Plenary Session Two
Grand Ballroom

Introduction of Speaker ................................................. Kirk E. Gavin, Ed.D.
Director, Center for Faculty Development & Research

Speaker .......................................................... Lawrence Morehouse, Ph.D.
Associate Professor and President and CEO for the Florida Education Fund

“Using Research: Preparing Students for College and Beyond”
# AFTERNOON BREAK-OUT SESSIONS

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<tr>
<td>Room 209</td>
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<td>Effect of FAMU Graduates on Pupil Learning in K-12 Education: A Value Added Analysis</td>
<td>Colin Anderson, Kirk Gavin, Gwanz Lufti, Nathaniel Johnson, and Patrick Mason</td>
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<td>Violence in American Schools</td>
<td>Tony Manson</td>
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<td>The Many Rewards of Mentoring</td>
<td>Patricia Powell</td>
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<td>Group II</td>
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<td>Room 210</td>
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<td>The Multivariate moving Window Spectral Method</td>
<td>Dennis Ridley and Pierre Ngnepieba</td>
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<td>2:35pm – 3:05pm</td>
<td>Chemical Signature of Forest Fire Smoke PM2.5 and Detection of its Presence in the Air</td>
<td>Y. ping Hsieh, Glynnis Bugna and Kevin Robertson</td>
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<td>3:45pm – 4:15pm</td>
<td>Computer Modeling of Carbon Foams</td>
<td>Ken Walsh</td>
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<td>Canopy Effect Droplet Size Distribution and Meteorological Change</td>
<td>Jane Barber</td>
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<td>2:35pm – 3:05pm</td>
<td>Plant Zonation in Costal Marshes and Its Potential to Indicate Climate and Sea-level Changes</td>
<td>Gajewska, I., Y.P. Hsieh</td>
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<td>3:10am – 3:40pm</td>
<td>The Influence of American Elitist Attitudes and Private Letters on President McKinley’s Decision for War</td>
<td>Bettye Grable</td>
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<td>Room 213</td>
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<td>Random Modeling The Structure of Carbon foam</td>
<td>Jidraph Njuguna, G. Dale Wesson, Desmond Stephens</td>
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<td>Development and Evaluation of Halophytes as Potential Biofuels Feedstock for the Production of Alternate Fuels for Army and Commercial Aviation</td>
<td>Clifford Louime</td>
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<td>3:10am – 3:40pm</td>
<td>A New Paradigm for Kinodynamic Motion Planning</td>
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<td>3:45pm – 4:15pm</td>
<td>Application of Ant Colony Optimization to Optimal Foraging Theory: Comparison of Stimulation and Field Results</td>
<td>Benjamin Legaspi, Crisostomo Legaspi, Jason Issac and Simon Foo</td>
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<td>4:20pm – 4:40pm</td>
<td>Closing Remarks / Next Steps Stay Tuned</td>
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Appendix A

1st Annual University Research Summit
College of Pharmacy and Pharmaceutical Sciences Building
March 26 – 27, 2009

Theme: “Building Research Capacity through Collaboration”

Dean Genniver Bell, Presiding
College of Education
Florida A&M University

Friday, March 27, 2009

7:30 a.m. – 8:20 a.m. ..........................................................Continental Breakfast
2nd Floor Student Lounge

8:30 a.m. – 9:45 a.m. ..........................................................Plenary Session Three
Room 103 Auditorium

Welcome.................................................................Gita Pitta, Ph.D.
Associate Vice President
Institutional Effectiveness

Introduction of Speaker.................................................Gwendolyn Trotter, Ph.D.
Teachers for A New Era

Keynote Speaker ..........................................................Ewart Thomas, Ph.D.
Professor, Stanford University

“Making the Connection: Research and Teaching in Higher Education”

Introduction of Moderator and Panel. .........................Rose Campbell, Ed.D.
Coordinator,
Teachers for A New Era
10:00 a.m. – 11:00 a.m. .................................................................Faculty Panel Discussion
Room 103 Auditorium

Dean Chanta Haywood, Ph.D., Moderator
College of Graduate Studies
Florida A&M University

“Building a Culture for Research that Enhances Teaching and Learning in the Academy”

Panelists
Peter Kalu  Serena Robert
Jennifer Cherrier  Brenda Jarmon
Sunil Pancholy  Karam Soliman
Henry Williams  David Jackson
Emma Dawson  Charles Weatherford
Dennis Ridley

11:05am – 11:30am  Acknowledgements/Closing Remarks
/Next Steps/ Stay Tuned
## Appendix B

### 1st Annual University Research Summit

**Participant List**

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<th>Research Category</th>
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<td>Physical and Engineering Sciences</td>
<td>Revegetation with Native Grass Species Following Mechanical and Chemical Control of Cogongrass (<em>I. cylindrica</em> L.)</td>
<td>Oghenekome U. Onokpise, Susan K. Bambo, and James J. Muhovej</td>
<td>College of Engineering, Sciences, Technology, and Agriculture (CESTA)</td>
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<td>College of Arts &amp; Sciences</td>
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<td>Clifford Louime, Ph.D</td>
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<td>Biological and Health Sciences Prostrate Cancer Treatment Patterns Among Racial/Ethnic Groups In Florida</td>
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<td>Analysis of Prostate Cancer Incidence in the State of Florida Using Geographic Information Systems and Multilevel Modeling</td>
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<td>Pierre Ngnepieba</td>
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