

**2006 AIR/NPEC RESEARCH GRANT PROPOSAL**

**State Paying for Grades and Student Decisions: Merit-Based Financial Aid and Student Pathways to the Baccalaureate Degree in Science and Engineering**

**Grant Amount Requested: \$27,728**

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## PROJECT SUMMARY

State sponsored merit-based financial aid programs have been enacted in many states across the country during the past decade. Since college grades are considered in the award renewal process, higher college grades become financially valuable to students in addition to their traditional academic value (Dowd, 1999; Hu, 2005). Considering the well-documented grading disparity across different disciplines, concerns have arisen over the impact of those programs on student course decisions and choice of major field (Hu, 2005; Sabot & Wakeman-Linn, 1991; Sloop, 2000). Such a possibility is particularly troubling for recruiting and retaining students in the fields of science and engineering since those are the ones that typically award lower grades to students (Hu, 2005; Johnson, 2003; Sabot & Wakeman-Linn, 1991). Therefore, the implementation of merit-based financial aid programs on the basis of college grades could likely affect student pathways to the baccalaureate degree in science and engineering. Moreover, the impact on student pathways could likely differ since students of different backgrounds may respond to the financial aid differently (St. John, 2003).

Using the student unit record data system in Florida, this project intends to empirically examine whether Florida's Bright Futures, a merit-based financial aid program, affects student decisions to pursue a science or engineering baccalaureate degree. The outcomes to be examined are a sequence of decisions including initial choice of a science or engineering field, change of major field, and completion of a science or engineering baccalaureate degree. Both longitudinal "before and after" approach and cross-sectional multivariate analysis for aid recipients and non-recipients will be used in data analysis. Variables concerning student background characteristics, high school curriculum and achievement, and college grades will be properly controlled for in statistical modeling. Additional analyses will be conducted by disaggregating student samples by gender, race/ethnicity, and college grades to examine possible differential effects of the program.

Findings from this study could have strong implications for state merit aid policies, institutional academic policies, and policies regarding science and engineering education, given that the United States is in need of maintaining and expanding the science and engineering labor force. The possible unequal impact of state merit-aid programs on educational decisions by students of different backgrounds may also raise concerns about achieving equal educational opportunity.

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## PROJECT DESCRIPTION

### A. Statement of problem

Financial aid programs in the United States were traditionally intended to eliminate the financial barriers for student participation in higher education so that equal educational opportunity could be achieved (Heller & Marin, 2002; St. John, 2003). This type of program has been known as need-based financial aid. However, the political landscape has changed dramatically in the financial aid policy arena. Since the inception of Georgia's HOPE scholarship program in 1993, state sponsored merit-based financial aid programs have been enacted in numerous states across the country (Cohen-Vogel, Ingle, Albee, & Spence, 2005; Heller & Marin, 2002). One of those states is Florida, which established the Bright Futures program in 1997. This program soon became the second largest merit-based scholarship program in the country (Cohen-Vogel, Ingle, Albee, & Spence, 2005). High school grades and SAT/ACT scores are used in initial qualification for Bright Futures and college grades are considered in scholarship renewal (Cohen-Vogel, Ingle, Albee, & Spence, 2005; Florida Department of Education, 2005; Heller & Rasmussen, 2002). The Florida Bright Futures Scholarship Program is comprised of the following three awards: Florida Academic Scholars Award (FAS), Florida Medallion Scholars Award (FMS), and Florida Gold Seal Vocational Scholars Award (GSV). These three awards use different eligibility criteria and provide different levels of financial support. Minimum cumulative GPA requirement for renewal is 3.0 for FAS and 2.75 for FMS and GSV (Florida Department of Education, 2005).

Scholarship policies based on college grades make grades both academically and financially valuable to students (Dowd, 1999; Hu, 2005). Considering the well-documented disparity in college grading practices across disciplines (Hu, 2005; Johnson, 2003), this could potentially alter student

pathways to a baccalaureate degree in some fields. Such a possibility is particularly troubling for recruiting and retaining students in the fields of science and engineering since these are the ones that typically award lower grades to students (Hu, 2005; Johnson, 2003; Sabot & Wakeman-Linn, 1991). This possible unintended consequence has strong implications given efforts in the United States to encourage the pursuit of careers in science and engineering and create a more scientifically literate citizenry—particularly among women and minority students (National Science Board, 2003).

Most research studies on merit-based financial aid programs focus on their impacts on college access and choice (Cornwell, Lee, & Mustard, 2003; Dynarski, 2004; Heller & Marin, 2002) and little is known about the potential impact on student choice of major field in general and in the fields of science and engineering in particular. Conceptual evidence has been presented in light of college grading problems (Hu, 2005). This study is posited to be one of the first to empirically examine the possible unintended consequence of merit-based financial aid on student pathways to the baccalaureate degree in science and engineering.

### Purpose

The purpose of this study is to examine the impact of Bright Futures, a merit-based financial aid program, on college student pathways to the baccalaureate degree in science and engineering. The guiding research question is: does Bright Futures affect student pathways to a science and engineering baccalaureate degree? Student pathways include a sequence of decisions pertaining to the initial choice of a science or engineering field, change of major field, and completion of a science and engineering baccalaureate degree. Because of the disparity in grading practices, it is hypothesized that Bright Futures could divert students away from science and engineering fields by affecting student initial choice, the pattern of change of major field, and the completion of the degree. It is further hypothesized that the impact could be different for students of different gender, race/ethnicity, and

students with different college grades (Dowd, 1999; Xie & Shauman, 2003). Since minority students on average come from economically more disadvantaged background than white students, they may be more sensitive to the availability of grant aid such as the Bright Futures award (St. John, 2003). It is then hypothesized that merit aid could more severely distort minority student pathways. It is also hypothesized that students with marginally eligible grades could be more likely to change their pathways in order to qualify for the award. There is no clear direction regarding whether women might respond to merit aid differently from men.

## **B. Proposed plan of work**

### Conceptual Framework

This study is based on three threads of the knowledge base: 1) Studies on financial aid in general and merit-aid in particular (Cornwell, Lee, & Mustard, 2003; Dynarski, 2004; Heller & Marin, 2002; Leslie & Brinkman, 1988; St. John, Asker, & Hu, 2001); 2) Research literature of college grading problems (Hu, 2005; Johnson, 2003; Kuh & Hu, 1999); and 3) Literature of student major choice and career choice (Feldman, Ethington, & Smart, 2001; Hearn, 1980; Holland, 1973; Xie & Shauman, 2003).

Research efforts on merit-based financial aid programs are extensive since the inception of the HOPE scholarship program. Studies have focused on the impact of those programs on college access, choice, degree completion, and credit hour accumulation (Cornwell, Lee, & Mustard, 2003; Dynarski, 2004; Heller & Marin, 2002). Those studies are critical in the understanding of the consequences of merit-based aid policies. However, little is known about how merit-based programs may affect student pathways to a science or engineering baccalaureate degree. St. John and his colleagues (St. John & Chung, 2004; St. John & Hu, 2006) have conducted some studies on the

relationship between financial aid and student choice of major. In their study of the Gates Millennium Scholarship (GMS) program, a program using non-cognitive measure as award criteria, St. John and Chung (2004) found some but not substantial evidence of the influence of GMS on student choice of major. In a recent study analyzing a national data set using hierarchical linear modeling, St. John and Hu (2006) found that need-based and merit-based state financial aid policies have different impact on student choice of major field, particularly for students from different racial/ethnic backgrounds. Using Kentucky's Educational Excellence Scholarship program as a case, Delaney (2005) proposed to examine whether merit-based aid could affect student choice of major in terms of "high risk" versus "low risk" field based on the distribution of grades.

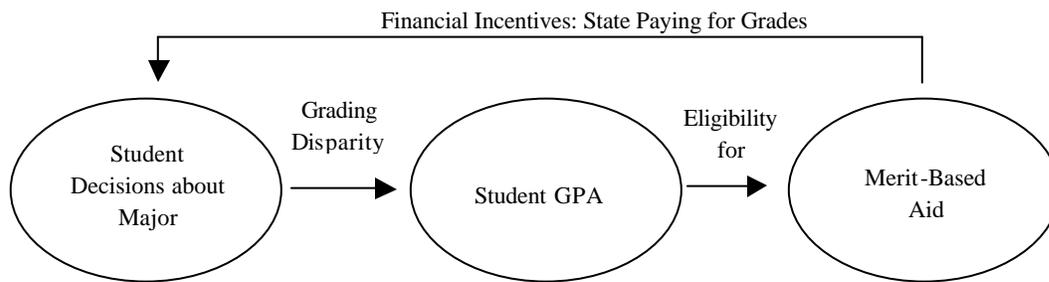
College grading practices have been at the center of controversy for decades (Hu, 2005). Recent scholarship has substantially advanced the understanding of the complexity of the problem. Johnson's study (2003) demonstrated the problem of grade inflation as well as grading disparity across disciplines. He asserted, "there is a consistent trend for humanities departments to grade leniently..., for social sciences departments to grade in an approximately neutral manner, and for natural science and mathematics departments to grade stringently" (p. 205). Sabot and Wakeman-Linn (1991) found a similar pattern in college grading and demonstrated that students respond to grading incentives in choosing their major fields. Hu (2005) speculated that merit-based financial aid programs based on college grades could further alter student decisions about course work and major field because the states are paying for grades through those programs.

Student choice of major field itself is a complex phenomenon and scholars from various disciplines have offered different perspectives. Some psychologists suggest that student choice of major field is a matter of a match between personality type and environmental characteristics of the major field (Holland, 1973; Feldman, Ethington, & Smart, 2001). Others suggest student choice of

major field is based on their assessment of their comparative advantage in terms of probability of success (Dowd, 1999). Sociologists argue that student choice of major field is dependent on individual background and his or her experiences (Hearn, 1980). Economists treat student choice as an investment decision by which students consider both the costs and benefits associated with their choice (Becker, 1994; Leslie & Brinkman, 1988; Montmarquette, Cannings, & Mahseredjian, 2002; St. John, 2003). It is reasonable to assume that merit aid could affect student decisions because it affects the costs of college education.

The conceptual framework of this study relies on the intersections of literature of student choice of major field, impact of financial aid, and grading disparity across disciplines in college. In addition to the impact of financial aid as demonstrated in other college choice literature (St. John, 2003), further linkage between merit-aid and student decision is the eligibility criteria of college GPAs and the problem of grading disparity (Hu, 2005; Johnson, 2003). Therefore, merit-based financial aid using college GPA as a criterion could motivate students to modify their decisions about major in order to be eligible for the award. This linkage is presented in Figure 1.

Figure 1. Conceptual framework for this study



## Empirical Analysis

### Data Source

The state of Florida is an ideal site to empirically examine the unintended consequences of merit-based financial aid on student decisions. The Bright Futures program is considered one of the most visible, large-scale, merit-based financial aid programs in the nation (Heller & Marin, 2002). The state also maintains one of the most extensive and integrated educational databases in the country—The Florida Education Data Warehouse (FEDW). The FEDW includes all education-related data collected by the state from public colleges and universities (e.g. student course work, grades), employment (e.g. wages, unemployment compensation), public schools (e.g. student achievement, students, teachers, school finances), as well as student demographic variables (Ewell, Schild, & Paulsen, 2003). Data from all of these sources can be linked together, making it possible to track individual students as they progress through public schools, matriculate to colleges and universities, and eventually enter the workforce. The data available in the FEDW regarding student college records dates well back before the inception of Bright Futures in 1997 so that a “before and after” comparison is possible. The data also provides a census, allowing for much finer analyses of different groups and sub-groups of students (Harris, 2005, personal communication). Cohorts of college students between 1995 and 1999 (the most recent cohort completing their baccalaureate degree within

six year time frame) will be analyzed for questions related to all the sequences in the pathways.

Analysis of large-scale national or state data has proven to be one of the most useful approaches in producing usable knowledge for policy discourse at the national and state level (Association of Institutional Research, 2005; Hu & St. John, 2001). Therefore, the FEDW will be used for the purpose of this study. Dr. Doug Harris, assistant professor at Florida State University, already has a license to use the FEDW data. Dr. Harris and I are leading a group of researchers in the State of Florida in a joint research proposal with RAND to the U.S. Department of Education using the FEDW. We are in the process in gaining a license to access to FEDW for all the researchers involved in that research project. A formal request of data access for the purpose of this project will be submitted to the Florida Department of Education in early 2006 for an anticipated starting date of June 2006.

### Analysis

On the pathways to the science and engineering baccalaureate degree, students have to make a sequence of decisions (St. John, Asker, & Hu, 2001; Xie, 1989; Xie & Shauman, 2003). More specifically, students have to make an initial choice of a college major, decide whether to change major field, and whether to persist and complete a baccalaureate degree. The science and engineering major in this study will be classified following NSF's classification of the Science, Technology, Engineering, and Mathematics (STEM) fields. Three sets of outcome variables will be examined: 1) Initial choice of a science or engineering major (yes/no); 2) Change of college major (departure from college, no change of major, migration out, and migration in); 3) Completion of a science or engineering baccalaureate degree within six years (yes/no).

Since the data provide a "before and after" comparison of student decisions regarding the implementation of the Bright Futures program, the analytical strategy will be a series of dichotomous

and multinomial logistic regressions that compare the outcomes of student cohorts before and after the implementation of Bright Futures (before code 0 and after coded 1), controlling for variables concerning student background characteristics, high school curriculum and achievement, and college performance (Cornwell, Lee, & Mustard, 2003; Long, 1997). Although enrollment and degree completion in science and engineering tend to fluctuate, the trend suggests that the fluctuation in a limited time span tends to be very small (National Science Board, 2004). Hence, the “before and after” comparison strategy should be adequate. For cohorts after 1997, student decision sequences will also be compared for the recipients and non-recipients, using method of dichotomous and multinomial logistic regressions (Long, 1997). Thus, both longitudinal and cross-sectional analyses will be conducted to examine the influence of Bright Futures on student pathways to baccalaureate degree in science and engineering. Further analyses will be conducted by disaggregating samples by gender, race/ethnicity, and college grades to examine the possible differential impacts of Bright Futures on student pathways.

### **C. Dissemination plan**

The principal investigator plans to present results from this project in the 2007 annual forum of the Association for Institutional Research (AIR) and the 2007 annual meeting of the American Educational Research Association (AERA). He also plans to present findings of this project in conferences with target audiences of policy analysts and practitioners such as the Student Financial Aid Research Network Conference jointly sponsored by the National Association of State Student Grant & Aid Programs (NASSGAP) and the National Council of Higher Education Loan Programs (NCHELP). Revised conference papers will be submitted to academic periodicals such as Research in Higher Education, Journal of Higher Education, and Journal of Student Financial Aid.

**D. Description of policy relevance**

With the increasing popularity of merit-based financial aid programs in the state policy arena, public policy makers need to have a better understanding of both the intended and unintended consequences of this type of program. Much has been discussed about the impact of merit-based financial aid programs on college access and choice, among other outcomes. However, relatively little is known about how these programs may affect student choice of college major, especially the science and engineering fields that are critical to the well-being of the individual, the state, and the society as a whole. Results from this study will shed new light on merit-based financial aid programs and create new linkages in the conversations about merit aid, academic policies in higher education institutions, and production of scientists and engineers.

**E. Discussion of innovative aspects of project**

The innovative aspects of this project include the conceptualization of the problem and the research design.

Moving beyond the focus of access and college choice, this project shifts the attention to student pathways to a baccalaureate degree in science or engineering, areas critical to a sustainable national economic development. The particular focus on student decision sequence of initial choice of a science and engineering major, change of major field, and completion of a science or engineering baccalaureate degree has strong policy implications at both the state and national levels. The explicit use of the literature on college grading (Hu, 2005) solidifies the conceptual basis for the hypothesized relation between merit aid programs and student pathways.

This project is also congruent with the increasing interest in utilizing state unit-record data for policy research to enrich public policy debate (Ewell, Schild, & Paulsen, 2003). The State of Florida,

in particular, is maintaining a comprehensive longitudinal data base that tracks student progression from high school to college and then to the labor market. This data base provides a unique opportunity to use both longitudinal and cross-sectional analytical approaches to gain a better understanding of the impact of a high-profile yet controversial state policy.

Finally, by separately examining student decisions by gender, race/ethnicity, and college grades, this project will shed light on the possible differential impact of a state policy on students of different backgrounds. This will contribute to the literature centering on how public policy influences the stratification process of educational and other opportunities.

#### **F. Discussion of audience to whom the project will be important**

Findings of this project will be of interest to public policy makers and higher education administrators.

For public policy makers, particularly state policymakers, it is important to have a comprehensive understanding of the intended and unintended consequences of merit-based aid program using grades as an eligibility criterion. The results from this study will raise awareness of possible unintended consequences of merit aid on student pathways to a science or engineering degree, which is of critical importance to national interests. Agencies and policy makers in charge of policies regarding science and engineering education will likewise benefit from the findings of this study.

For higher education administrators, the results from this study will highlight that the widespread grading disparity among disciplines could distort student educational and career decisions. This will become more acute in a policy environment that allows college grades to determine

substantial financial incentives to students. Appropriate institutional planning and policies are needed to avoid those unintended consequences.

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## **BIOGRAPHICAL SKETCH**

Dr. Shouping Hu is Associate Professor of Educational Leadership and Policy Studies in the College of Education at Florida State University. He earned a B.S. in geography and had two years of graduate study in higher education at Peking University. He completed an M.A. in Economics and a Ph.D. in Higher Education at Indiana University. His current research focuses on public policy and student decisions about higher education.

Dr. Hu's academic background enables him to deal with educational problems from a multidisciplinary approach. He has extensive experience using statistical packages such as SPSS, Stata, and hierarchical linear modeling (HLM) to analyze large-scale databases including Indiana Higher Education Student Information System and College Student Experience Questionnaire (CSEQ). Previously, Dr. Hu participated in the AERA Institute on Statistical Analysis for Education Policy and the AIR Summer Data Policy Institute On the Databases of the NCES and the NSF. His research work has been published in the most vigorously reviewed journals in the field such as Journal of Higher Education, Research in Higher Education, Review of Higher Education, Educational Evaluation and Policy Analysis, and Journal of College Student Development. In addition, he has presented scores of papers at American Educational Research Association (AERA) and The Association for the Study of Higher Education (ASHE).

### **Education**

- ?? Ph.D. in Higher Education, Department of Educational Leadership and Policy Studies, Indiana University Bloomington. Major: Higher Education; Minor: Economics (July 2000)
- ?? M.A. in Economics, Department of Economics, Indiana University Bloomington (July 1998)
- ?? M.A. student in Higher Education, Institute of Higher Education, Peking University, P. R. China (September 1993 – July 1995)

?? B.S. in Geography, Department of Geography, Peking University, P. R. China (July 1992)

### **Professional Experience**

?? August 2004 – Present

Associate Professor, Department of Education Leadership and Policy Studies, College of Education, Florida State University, Tallahassee, FL 32306

?? September 2000 – July 2004

Assistant Professor, Department of Education Leadership, Management and Policy, College of Education and Human Services, Seton Hall University, South Orange, NJ 07079

### **Research**

#### **Refereed Journal Article**

?? Hossler, D., Hu, S., & Schmit, J. (1999). Predicting student price sensitivity to tuition and financial aid. Journal of Student Financial Aid, 29 (1), 17-33

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### **Book**

?? Hu, S. (2005). Beyond grade inflation: Understanding grading problems in higher education. ASHE Higher Education Report Series, Volume 30, Number 6. San Francisco, CA: Jossey-Bass.

### **Book Chapter**

?? St. John, E. P., Asker, E., & Hu, S. (2001). The role of finances in student choice: A review of theory and research. In M. B. Paulsen & J. C. Smart (Eds.), The finance of higher education: Theory, research, policy, and practice (pp. 419-438). New York: Agathon.

### **Research Report**

?? St. John, E. P., & Hu, S. (2004, April). Washington State Achievers program: Its influence on student postsecondary opportunities. Submitted to Bill & Melinda Gates Foundation, Seattle, WA.

?? St. John, E. P., & Hu, S. (2005, September). Gates Millennium Scholars program: Its influence on student college choice, persistence, and graduate educational decisions. Submitted to Bill & Melinda Gates Foundation, Seattle, WA.

### **Teaching/Advising**

?? Graduate-level courses taught at Florida State University  
 Basic Understanding of American Higher Education; Higher Education Finance; Prospectus Development; State Education Policy; Special Topic : Student Success in College; Special Topic :

International Perspectives in Higher Education;

?? Graduate-level courses taught at Seton Hall University

American College Student; Directed Research; Dissertation Seminar in Higher Education;

Education Policy Analysis; Higher Education Finance; Introduction to Higher Education

?? Dissertation Mentor for doctoral students at Florida State University and Seton Hall University

**Other Selected Professional Activities**

?? Emerging Scholar award, American College Personnel Association (ACPA), 2004

?? Editorial Board member, Journal of College Student Development, 2003 – Present

?? Reviewer, Institute of Education Science in the U.S. Department of Education, University Grants

Committee (UGC) of Hong Kong, Journal of Higher Education, Research in Higher Education,

Review of Higher Education, Higher Education, Educational Evaluation and Policy Analysis,

Urban Education, and Teachers College Record

## BUDGET

### A. Personnel

Principal Investigator	
100% of Summer 2006 (2/9 of academic year salary)	\$12,893
12.5% of academic year of 2006-07 (estimated 3% increase in salary)	\$7,470
Sub-total of salary	\$20,363

### B. Fringe Benefits

18.38% of salary	\$3,743
Health insurance (12.5% of yearly rate at \$5,375.52)	\$672
Sub-total of fringe benefits	\$4,415

### C. Travel

Paper presentation at AERA (2007) & AIR (2007) (\$1,550 for AERA and 1,400 for AIR)	\$2,950
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**Total Project Costs** **\$27,728**

### Budget Narrative

The budget item of Personnel (section A) covers two months of salary for the principal investigator in the summer of 2006 and 1/8 of salary for the academic year of 2006-07. This budgetary support will allow the PI to concentrate on this project in the summer of 2006 and spend 25% of the fall semester of 2006 working on this project.

Fringe benefits (section B) were calculated at the university stipulated rate of 18.38% for a sponsored research project, plus a portion of health insurance on the basis of PI's time on the project.

Travel support (section C) will enable the PI to present findings of this project at the AIR annual forum and the AERA annual meeting in 2007. The budget costs for the AERA trip include round-trip air fare, conference registration fees, ground transportation, four-night lodging at AERA,

and meals, totaling \$1,550. The same items are budgeted for the AIR trip but one-night less in lodging costs, totaling \$1,400. In addition, the PI anticipates his current university will be able to fund a trip to present the findings of this project in the Student Financial Aid Research Network Conference jointly sponsored by the National Association of State Student Grant & Aid Programs (NASSGAP) and National Council of Higher Education Loan Programs (NCHELP).

Other costs for this project including photocopies, phone calls, and publication costs will be covered by PI's university.

The total requested support from AIR for this project is \$27,728.

### **CURRENT AND PENDING SUPPORT**

The principal investigator is one member of a team in a proposal for a research and development center in postsecondary education submitted to the Institute of Education Sciences of the U.S. Department of Education but has no current or pending support for this study.

## **FACILITIES, EQUIPMENT AND OTHER RESOURCES**

Florida State University is a doctoral/research-extensive university in the 2000 Carnegie classification of higher education institutions and is aspiring to attain membership of the Association of American Universities (AAU). The leadership in the College of Education advocates research that can make differences in educational practice and public policy debate. Both the university and the college have strong commitment to research activities undertaken by faculty members. The university already provided the PI a computer in his office and statistical software such as SPSS, Stata, and HLM are also in place. The proposed project requires no special equipment.

**SPECIAL INFORMATION AND SUPPLEMENTARY DOCUMENTATION**

Not relevant.