CREATING A RESEARCH-RICH CURRICULUM
MIAMI UNIVERSITY

Program Description:
Miami University has attempted in recent years to build upon a collection of student research participation opportunities at the University, and develop a comprehensive "research-rich" undergraduate curriculum. A major step in this direction was the creation in 1995 of the Undergraduate Summer Scholars (USS) program. This program provides 10-week summer research experiences with faculty mentors for 100 juniors or seniors each year. The USS Program is not limited to science and engineering areas, as approximately 28 academic departments participate annually. Program features are:

- a student fellowship of $2,200
- 12 hours of academic credit with waiver of instructional fees and tuition
- a project allowance of $300 for supplies, services, and travel
- a faculty allowance of $500 to be used for faculty scholarly activities or to assist the student project

Development of the formal USS program at Miami built upon the University's prior experience with student research appointments funded by the Howard Hughes Medical Institute, the National Science Foundation, and other sponsoring agencies. In most instances, students participating in these research programs received no academic credit for these learning experiences. An important outcome of the University's evaluation of these earlier student research experiences was recognition that such experiences were as significant to a student's education as formal course work, and thus should be accompanied by academic credit.

Benefits of the program include:

- adding a distinctive experience to the education of Miami student participants
- increasing interaction between faculty and students, developing communities of learners
- linking research and teaching at the University
- enhancing faculty research through the participation of talented undergraduates
- providing an educational experience shown to increase intellectual maturity
- improving the University's ability to attract talented students

A second important step in Miami's effort was obtaining a grant of $200,000 in 1996 from the National Science Foundation's Comprehensive Reform of Undergraduate Education program. This funding enabled the University to carry out a project to enhance the Undergraduate Summer Scholars (USS) Program and evaluate student intellectual growth within this program. Two outcomes of this NSF-funded project are noteworthy: first, the USS program now is firmly established within the University's offerings; second, the evaluation indicated profound student intellectual growth as a result of mentored research experiences.

Significance of the Program:
Many universities and other organizations involved in undergraduate research programs have evaluated the undergraduate research experience. To a great extent, however, these evaluations have measured student and faculty mentor satisfaction with the experience and, in some cases, subsequent student success in careers. Many who have been involved with undergraduate research believe that, over and above this satisfaction, a genuine maturation in students' intellectual abilities and habits frequently results from an undergraduate research experience. Preliminary studies at Miami University suggested to us that considerable student intellectual development resulted

from participating in a mentored, independent research experience, and that the effect might be measurable.

We initiated a study to attempt to measure this effect in 1997. Our subsequent test group consisted of student participants in Miami University's Undergraduate Summer Scholars program in summers of 1997 and 1998. The study utilized the Epistemological Reflection Model created by Miami faculty member Marcia Baxter-Magolda as the framework for assessing student intellectual development. This model had been created by Baxter-Magolda in the course of a longitudinal study to assess the degree to which Miami undergraduates achieved independent thinking. The model assumes a journey from simplistic to complex thinking similar to other models of intellectual development including Perry's scheme, King and Kitchener's reflective judgment model, and Belenky, Clinchy, Goldberger, and Tarule's model for women's development. Baxter Magolda's previous longitudinal study of Miami undergraduates had revealed four categories of ways of knowing. In "Absolute Knowing" (category 1), students believe that knowledge is certain; their role as learners is to obtain it from authorities. In "Transitional Knowing" (category 2), students believe that some knowledge is less than absolute; their role shifts to finding processes to search for the truth. In "Independent Knowing" (category 3), students believe that most knowledge is less than absolute, and individuals can have their own beliefs; they think for themselves. In "Contextual Knowing" (category 4), students believe that theories are constructed in a context based on judgment of evidence; their role is to exchange and compare perspectives, think through problems, and integrate and test theories.

Our study of 1997 and 1998 research participants and a control group found that participation in the USS experience promoted epistemological development for many students. The most prevalent change was from transitional (category 2) to independent (category 3) knowing, because the majority of USS participants initially were transitional knowers. Thirty-one percent of the USS participants shifted to independent knowing after their USS experience; none of the comparison group exhibited this shift. Absolute (category 1) knowers also experienced growth to transitional (category 2) knowing.

This epistemological change during the USS experience is remarkable when viewed in the context of extensive previous research on college students' epistemological growth. Traditional age college students often have been shown to spend the majority of their college years as transitional (category 2).

The data collected in our Miami project strongly support the anecdotal evidence accumulated for many years concerning the profound impact of undergraduate research experiences on student intellectual development. The data also are strongly supportive of the Carnegie Foundation's recommendation in "Reinventing Undergraduate Education: A Blueprint for America's Research Universities" that research universities make increased use of research participation as an educational mechanism.

<u>Considerations in Adopting this Program</u>

The principal obstacle to adoption of the Undergraduate Summer Scholars program is financial. Costs of the program are outlined above, and include $3,000 per student in cash outlays, as well as lost income associated with waiver of instructional fees and tuition for 12 hours of academic credit per student.

Our experience at Miami University is that the lost income turns out to be considerably less than might be expected for two reasons: first, some of the participants already hold academic scholarships; second, the USS credits are earned during the summer, and

participants generally do not reduce their subsequent academic-year course load by 12 credit hours, i.e., they graduate from Miami with more than the required number of credits.

Another consideration for state universities contemplating adoption of the program is the subsidy provided by the state of Ohio for student academic credit associated with the student research experiences. In the current year, state subsidy to Miami University for the USS program ranges from $1,500 to $3,500 per student, depending upon the field of study. While these funds are not sufficient to make the USS program self-supporting, they do lessen the deficit associated with the program.

Our analysis of the costs and benefits at Miami University concluded that the benefits of the program were substantial enough to merit funding, first from discretionary funding available to the provost, and subsequently from the university's baseline scholarship budget.

One final noteworthy consideration relative to adoption of the USS program is its appeal to alumni and other potential donors who have strong feelings about the benefits of undergraduate research. Our hope at Miami is that eventually the program will be endowed by friends of the university and undergraduate research.

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This summary of an exemplary project is provided by The Ohio Project: Collaborating to Enhance Undergraduate Science Education within Ohio, funded by an Efficiency Challenge grant from the Ohio Board of Regents.