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A Longitudinal Student Outcomes Evaluation of the Buffalo State College Summer Undergraduate Research Program

The Program

Buffalo State College (Buffalo State) is the largest of the 13 colleges of arts and sciences in the SUNY (State University of New York) system. Its total enrollment is nearly 11,000, with an undergraduate enrollment of 9,139. Experiential pedagogies, including undergraduate research, are reflected across the undergraduate programs and Buffalo State College has placed increasing emphasis and resources on expanding undergraduate research opportunities for students in all academic disciplines. Our use of the term 'research' is broadly defined by the standard practices established within each academic discipline and includes scholarship and creative activities. It is assumed that the activity will produce original results and contribute to the body of knowledge and creative works within a discipline.

Coordinated campus-wide undergraduate research opportunities were introduced at Buffalo State more than ten years ago. In 2003, as part of the College's efforts to institutionalize undergraduate research, an Office of Undergraduate Research was established and a half-time director was appointed in order to better promote and expand opportunities for students to participate in undergraduate research. This office administers programs to support academic year and summer research, including travel support for students to present at conferences and juried art shows; supply and travel support for small projects; faculty development to support efforts to integrate research into a new or revised course; and an annual campus-wide celebration of research and creativity activities. The summer research program supports eight weeks of full-time research, scholarly, and creative activities. Each award provides a student stipend of \$2,500, a faculty stipend of \$1,000, and \$500 for travel and supplies to support the project. Since the inception of the summer research program, a total of 112 awards have been made. Program guidelines and a link to the online application for the summer research program can be found at <http://www.buffalostate.edu/undergraduate-research/x504.xml>. All of the programs administered by the Office of Undergraduate Research are supported by Buffalo State funds, including a portion of overhead derived from external grants. Table 1 provides an overview of the Buffalo State undergraduate research programs.



Amelia Alessi, summer research student, assessed population diversity in Bald Eagle populations in the Northeastern United States. She traveled to Maine in order to help collect feathers from young eagles.

Buffalo State undertakes regular evaluation of all academic programs, including those programs administered by the Office of Undergraduate Research. The design of the evaluation effort is determined by the program and evaluation results are included as part of the program's annual report. Because the summer research program was one of the longest running programs (now entering its eleventh year) and accounts for nearly half of the annual operational budget of the Office of Undergraduate Research, it became the focus of our most recent evaluation efforts.

Background of the Evaluation

We were interested in developing a program evaluation that could provide a reliable assessment of the impact of our summer research program on the student participants. There have been many valuable studies of the effects of undergraduate research on participating students. These studies have identified many possible impacts of undergraduate research and have raised a number of important issues associated with this teaching pedagogy. Most of this work has relied on interviews

Table 1: Buffalo State Undergraduate Research Programs

Program	Description	Size of Award
Small Grants	Program assists students in carrying out research and creative activities during the academic year. The award is designed to help defray the cost of travel, supplies, and other materials necessary to conduct the project.	\$400
Undergraduate Travel	Program provides partial support for students to attend conferences. Eligibility requirements require that the student be the first author on the abstract or artist statement. As funds are available, faculty mentors may also receive travel support to accompany the student.	\$400 Higher amounts for international travel
Integration of Undergraduate Research into the Curriculum	Program supports the development of new courses and/or the revision of existing courses to include a substantial undergraduate research component. Course can be at introductory or advanced level and designed for non-majors or majors.	\$750-1000
Summer Research	Program supports eight weeks of full-time research, scholarly and creative activities.	\$4000
Student Research and Creativity Celebration	Annual event provides students an opportunity to present their preliminary and completed research and creative activities. A variety of presentation formats are possible: theatrical and musical performances, gallery exhibits, posters, talks, and demonstrations. Individual, small group and class projects are eligible.	Not applicable

with or surveys of student participants and/or faculty advisors who were asked to identify the benefits of the undergraduate research experience (see e.g., Merkel, 2001; Seymour, et al, 2004; Lopatto, 2004; Hunter, et al, 2007). Singer sought an evaluation that, while it might include survey and interview methods, also would go beyond such measures to develop a wider array of evidence bearing on program impact. Many undergraduate research programs, moreover, have focused largely on students in science, technology, engineering and mathematics (STEM) disciplines, whereas the Buffalo State program makes a point of also recruiting students from the arts and humanities, and Singer felt it important to develop measures that would capture the program's impact on these students as well as outcomes for STEM students.

Singer therefore contacted a consulting firm that specializes in the independent evaluation of educational programs (Weiler) whose work she was familiar with from other projects in which they had both been engaged, to discuss ideas for how such an evaluation might be designed and implemented. This article describes the objectives, design approach, protocols and procedures of the evaluation that emerged from that initiative.

Evaluation Objectives

We agreed that an evaluation of the summer research program should have four purposes. The evaluation should: (1) obtain reliable assessments of the program's impact on participating students, based on a variety of measures; (2) provide information to participating students that clarifies what we hope they will learn and provides a mechanism to help them assess their academic strengths and weaknesses; (3) begin the creation of a longitudinal database that can provide data on the impact of undergraduate research on a range of outcomes for students from a variety of academic disciplines; and (4) serve as a model that could be adapted by other institutions to evaluate their own UR programs.

Design Approach

We decided to begin by creating a list of broad outcomes that faculty from a variety of disciplines wished to measure, together with language that would spell out in more concrete detail the specific elements of each outcome that should be

measured. This initial product would serve as the basis for the drafting of an assessment instrument to be used by faculty mentors of students in the program. Accordingly, Singer organized and we both led a two-day meeting at Buffalo State in June 2006 of a faculty working group consisting of nine faculty members from eight different disciplines. The working group identified a wide range of student outcome categories of interest and drafted language that defined the specific outcome components of interest for each category. With this initial guidance from Buffalo State faculty, Weiler drafted a comprehensive evaluation design and we collaborated to refine and flesh out the draft outcome categories and components identified by the working group.

Evaluation Pilot Study

Our preliminary evaluation design included:

- a student survey designed to provide faculty mentors with information about participating students as they embarked on their summer research projects;
- preliminary student assessments made by faculty (using the outcome components described above), based on information from the student survey and initial student interviews;
- preliminary student self-assessments, using the same instrument employed by faculty;
- journals to be kept by both students and mentors, for faculty to record observations pertinent to their assessments, and for students to keep track of their progress and as a resource for discussions with their faculty members
- mentor and student mid-point and final progress reports, including assessments and self-assessments, respectively;
- mentor and student group discussions, to probe in depth their perceptions of summer program strengths and weaknesses, benefits, recommendations for changes, etc.; and
- an alumni survey, to obtain retrospective student views on program strengths and weaknesses and perceived benefits.

We arranged to pilot test these evaluation components and instruments (except for the alumni survey) during the 2007 summer research program, using five pairs of students and faculty mentors from four different disciplines. The pilot included both experienced and new mentors, to ascertain whether academic discipline or degree of mentor experience made

any difference to student and mentor views on the relevance and usefulness of each evaluation component and the ease of use of evaluation instruments. Following the pilot test, we held separate group discussions with the participating faculty and students. The discussions confirmed that both faculty and students found the evaluation instruments easy to use, while at the same time there was some concern that the multiplicity of required evaluation components was more burdensome than necessary and that some simplification of the instruments would be useful.

Revised Evaluation Components

With the input from the fall 2007 group discussions and important contributions from Carol Beckley, a faculty member in the Theater Department, we refined the evaluation for use across the entire 2008 summer research program. In our pilot effort, we had asked mentors and students to make broad outcome assessments on a four-point scale after reviewing language that specified the components of each outcome. For example, we asked for an assessment of student “creativity,” and provided language that described four distinct characteristics of that outcome, (discussed below). Feedback from the faculty mentors pointed out the problems from assigning a single score to represent several components within a single outcome category. This often caused the mentor to either ignore a component or average the range; in either case, information was being lost. A second request from the focus group participants was for a greater range for the outcome scores (changing from a four-point to a five-point scale) and the addition of a ‘not applicable’ option. These changes were incorporated into the revised instruments used in the full-scale study conducted in the summer of 2008.

The evaluation, which we intend to use again during the summer programs of 2009 and beyond, has the following components. All of the instruments and guidelines described below can be found (as static versions) on a link from the Buffalo State Office of Undergraduate Research website <http://www.buffalostate.edu/undergraduateresearch/x561.xml>

1. Student survey. Students who are accepted to the program complete a survey designed to provide information about their motivation, knowledge and expectations, and their understanding of their academic strengths and weaknesses. The survey has two main purposes: (1) to provide faculty mentors with insights

Table 2: Student Outcome Categories Assessed as Part of the Evaluation

Communication
Creativity
Autonomy
Ability to deal with obstacles
Practice and process of inquiry
Nature of disciplinary knowledge
Critical thinking and problem solving
Understanding ethical conduct
Intellectual development
Culture of scholarship
Content knowledge skills/methodology

into student knowledge and thought processes, as an aid to the mentors in completing preliminary student assessments; and (2) to provide students with a structured opportunity to explore their own goals, knowledge, and readiness for the program. (The mentor's copy of the survey instrument shows the relationship between each survey question and relevant student outcomes.)

2. Student intake interview. Faculty mentors conduct "intake interviews" (intended more as conversations than formal interviews) with the students they will be working with, in order to help the mentors learn enough about the students to formulate preliminary assessments. Mentors are encouraged to probe the students about their answers to the student survey and to ask additional questions if necessary. The mentors are provided by the evaluation with a list of candidate questions for this purpose, showing the relationship between each candidate question and relevant student outcomes.

3. Mentor's preliminary student assessment. Faculty mentors are provided with an assessment instrument that lists 11 outcome categories, including the specific components of interest for each category. For each outcome component, the mentors are asked to give their students a preliminary score on a five-point scale (the student *always, usually, often, seldom* or *never* displays the outcome of interest, unless the component is *not applicable*). In addition, given that mentors may not have equally rich or compelling information about their students across every outcome component listed, the mentors

are asked to indicate, for each score, their level of confidence in the score (*very, fairly, somewhat, not terribly, or not at all* confident). Table 2 shows the student outcome categories employed for these assessments.

On the assessment instrument provided to the faculty mentors, each of these outcome categories includes a list of the specific outcome components that faculty are asked to assess using the five-point scale described above. For example, for the outcome category called "creativity," the components to be assessed are:

- brings new insight to the problem at hand;
- shows ability to approach problems from different perspectives;
- combines information in new ways and/or demonstrates intellectual resourcefulness; and
- effectively connects multiple ideas/approaches.

For the outcome category called "ability to deal with obstacles," the components to be assessed are:

- learns from and is not discouraged by set-backs and unforeseen events; and
- shows flexibility and a willingness to take risks and try again.

This pattern is followed on the assessment instrument for all 11 outcome categories. The instrument provides space for the faculty member to indicate his or her assessment score and confidence level, as well as space for indicating why an assessment score has changed between preliminary and later assessments (discussed below).

4. Mentor journals. Mentors are strongly encouraged, but not required, to maintain written records in the form of informal journals in which they record observations, analyses, comments, questions and conclusions that are relevant to the student outcomes they are being asked to assess.

5. Student preliminary self-assessment. Students in the program complete the same assessment instrument described above in Step 3.

6. Mentor-student meeting to compare assessments. Mentors and students meet in order to compare assessments and discuss the reasons for any differences. These discussions are intended to provide the mentors with information about the extent of their students' self-knowledge, provide the students

with opportunities to obtain more realistic assessments of their strengths and weaknesses, and make program expectations explicit and transparent so that students can strive to excel on each outcome where they are being assessed. The discussions also give the students opportunities to bring new information to bear on their mentor's preliminary assessments.

7. Student journals. Students are strongly urged, but not required, to maintain a journal in which they can record their questions, concerns, ideas and observations as they conduct their summer research projects. They are provided by the evaluation with journal guidelines that include a list of candidate topic areas (ideas, hypotheses, observations, evidence, obstacles, etc.) to bear in mind as they proceed.

8. Mentor and student mid-project assessments. Approximately mid-way through the summer research projects, mentors and students repeat Steps 3 and 5 as part of their mid-project progress reports. The mentors and students both indicate, where appropriate, the main reasons for any change in their assessment/self-assessment scores since their preliminary assessments conducted at the outset of the program.

9. Mentor and student final assessments. At the completion of the summer research program, mentors and students repeat Steps 3 and 5 as part of their final reports. The mentors and students both indicate, where appropriate, the main reasons for any change in their assessment/self-assessment scores since the mid-project assessments that they conducted approximately half-way through the program.

10. Alumni survey. Students who have completed the summer research program in 2008 will be asked a year later (i.e., in the fall of 2009), to complete a brief survey soliciting assessments of their undergraduate research experience along various dimensions. An alumni survey will likewise be sent to the 2009 participants in the fall of 2010, and so on.

The instruments described above – mentor and student outcomes assessments, student survey, alumni survey – are all designed to be completed on a website accessed by authorized users, with the resulting data flowing automatically to a database maintained by a Buffalo State-based evaluator responsible for the data analysis. The web-based format permits “unlimited” comments to be entered by mentors and students in providing explanations for differences in assessment scores between the preliminary, mid-project and final

assessments. Mentors and students who maintain journals are also encouraged to do so in computer format. The evaluation instruments discussed above cover a wide range of potential student outcomes and should be readily adaptable to a variety of undergraduate research programs, both summer and academic year. Other institutions may wish to adapt these evaluation instruments to reflect the emphases of their own undergraduate research programs and the particular interests of their own faculty.

An analysis of the first round of data from the evaluation (from the 2008 summer research program at Buffalo State) is currently being conducted and will be reported in a future article and on the Buffalo State Office of Undergraduate Research web site. The analysis report will include a comparison group study that was not part of the evaluation design but is being conducted independently by another member of the Buffalo State faculty.

Concluding Remarks

Our efforts to determine the impact of the summer research program are ongoing. Initial feedback from the faculty and students who participated in the summer 2008 program included a suggestion to reduce the number of assessment surveys (perhaps by replacing the mid-summer survey with a shorter version). Both mentors and students found the initial interview helpful, particularly when the student and mentor had limited prior interactions. They also reported that mentor-student conversations after completion of the assessment surveys facilitated the sharing of ideas and a review of student progress. The students especially liked learning more about how they were doing.

The evaluation also may provide an opportunity to shed some light on a long-standing methodological debate. In all student self-reports, whether they are part of local or national surveys or end-of-course evaluations at a school, the chronic criticism is that students cannot be trusted to make good self-assessments. Our evaluation at Buffalo State could provide an opportunity to test the validity of student self-assessments by studying the concordance or discordance between student and mentor assessments. If student self-reports become more credible with each round of evaluation, we might hypothesize that our evaluation has cultivated “metacognition” in students.¹

¹ The authors are indebted for this point to David Lopatto, Samuel R. and Marie-Louise Rosenthal Professor of Natural Science and Mathematics, Psychology Department, Grinnell College

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