



Faculty Perceptions of Undergraduate Research

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Background

According to the Council on Undergraduate Research (2009), undergraduate research is defined as “an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline.” There are many benefits for students who conduct undergraduate research. Undergraduates who conduct research show improvements in thinking independently, thinking critically, putting ideas together, solving problems, analyzing data, analyzing literature, interpreting research findings, conducting ethical research, and giving presentations (Bauer & Bennett, 2003; Chopin, 2002; Hu, Scheuch, Schwartz, Gayles, & Li, 2008; Hunter, Laursen, & Seymour, 2006; Ishiyama, 2002a; Mateja & Otto, 2007; Thiry & Laursen, 2009). The intellectual gains may be especially pronounced for students who start undergraduate research in their first or second years (Ishiyama, 2002a) and for underrepresented students (e.g., women, minority students; McKinney, Saxe, & Cobb, 1998). Students who participated in undergraduate research scored higher on a test of knowledge of their major than comparable students who did not participate in undergraduate research (Ishiyama & Bruening, 2003). Students who are involved in undergraduate research are more likely to have plans to attend graduate school (Hunter et al., 2006) and to actually attend graduate school (Alexander, Foertsch, Daffinrund, &

Tapia, 2000; Ishiyama, 2002b) compared to students who are not involved in undergraduate research.

Although much research has examined students’ experiences conducting undergraduate research, faculty members’ experiences with and perceptions of undergraduate research have not been examined in as much depth. It is vitally important to examine faculty experiences because they are the individuals who supervise the students. Students will not experience the numerous benefits of undergraduate research if faculty members cannot or will not supervise them. As Thiry and Laursen (2009) noted, it is rare for students to have enough opportunity to really gain higher-order thinking skills from their undergraduate research experiences.

Therefore, the purpose of our study was to examine undergraduate research from the perspective of the faculty mentors. Specifically, we aimed to examine faculty members’ experiences supervising undergraduate research, faculty members’ perceptions of the skills that students obtain in research, benefits of undergraduate research for faculty, barriers of undergraduate research for faculty, and factors that would increase faculty participation in undergraduate research.

Faculty Members' Experiences Supervising Undergraduate Research

Little empirical research has examined faculty members' actual experiences supervising undergraduate research, including how many students they supervise, how long they spend with their undergraduate researchers, how the research partnership starts, etc. In a survey of faculty from 209 schools across the United States, faculty reported spending about 2.5 hours per week working with students out of nine hours per week total spent each week on research and scholarly activities (Kuh, Chen, & Nelson Laird, 2007). The amount of time spent by faculty working on research and their perceptions of the importance of research with undergraduates had a positive effect on whether students would do research (Kuh et al., 2007).

At the University of Delaware, almost all faculty members supervise undergraduate researchers (Zydney, Bennett, Shahid, & Bauer, 2002). Faculty there reported that usually the students approached them to ask to be involved in research, although some faculty reported that they approached talented undergraduates from their classes to be involved in research. Many faculty members (50%) reported spending one to two hours per week supervising undergraduates in research, while 40% reported spending three to five hours per week. Zydney et al. (2002) also found that faculty supervised an average of 1.5 students per year. Most faculty members reported working with each student for at least a year.

Faculty Ratings of the Skills Obtained by Undergraduate Researchers

Research has shown that students perceive themselves to have gained research skills as a result of conducting undergraduate research, but do faculty members also perceive these gains? Faculty members have tended to strongly agree that students gain the ability to collect data (Cox & Andriot,

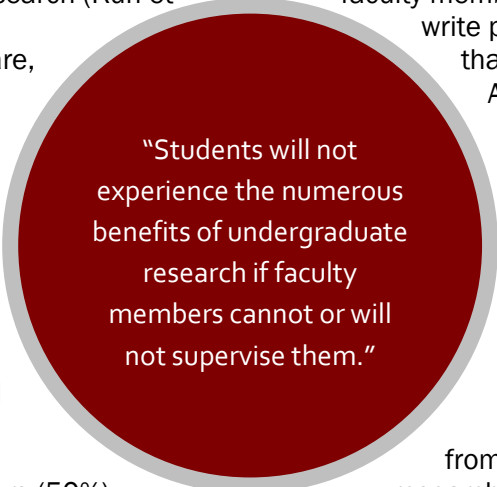
2009; Kardash, 2000), relate well to people of different backgrounds (Cox & Andriot, 2009), and work in teams (Cox & Andriot, 2009; Zydney et al., 2002). Faculty members have also rated students relatively high (above the midpoint) on skills such as understanding and synthesizing the research in the discipline, formulating a hypothesis, designing a study, analyzing data, orally presenting results, thinking creatively, and thinking independently (Kardash, 2000; Zydney et al., 2002). Faculty members have indicated that their students gained the following skills from undergraduate research: learning a topic in depth, applying knowledge to a real situation, learning appropriate language and proficiency in lab techniques, and learning to work and think independently (Lopatto, 2003). Typically,

faculty members rate students' ability to write papers for publication as lower than other research skills (Cox & Andriot, 2009; Hunter et al., 2006; Kardash, 2000).

According to Hunter et al. (2006), students rarely get the opportunity to publish papers based on their research.

Benefits of Undergraduate Research for Faculty

Clearly, students benefit from conducting undergraduate research, but do their faculty mentors experience benefits as well? Some faculty members report that working with students on undergraduate research gives them the personal satisfaction of helping students grow and professionally develop (Cech, 2003; Chopin, 2002; Hunter et al., 2006; Perez, 2003; Russell, Hancock, & McCullough, 2007; Zydney et al., 2002). The faculty members themselves can experience professional and intellectual growth as a result of their experiences supervising undergraduate researchers (Chopin, 2002; Mateja & Otto, 2007). Furthermore, departments can use undergraduate research projects to assess how well they are doing as a department (Chapman, 2003). Students bring energy and enthusiasm to the research process (Coker &



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Davies, 2006). Mays Hoopes (1993) noted that although professors who work with students see slower rates of progress, they can sometimes experiment with high-risk, low-cost projects to investigate new areas of research. Showcasing students' research at undergraduate conferences highlights the hard work of the students and their faculty mentors, which can create a campus climate focused on science (Chapman, 2003). In addition, faculty members who engage in undergraduate research may become better teachers due to their knowledge of cutting-edge research (Brandenberger, 1990; Chapman, 2003; Mateja & Otto, 2007).

Many faculty members are motivated by the help that they receive from undergraduates on their research projects (Zydney et al., 2002). As Howes et al. (2005) noted, "Undergraduates are inexpensive and intelligent labor" (p. 125). Students can help faculty members "think outside the box" and bring fresh perspectives to research on new topics (Cech, 2003; Coker & Davies, 2006; Zydney et al., 2002). Undergraduate research may help faculty members with tenure and promotion (Leslie, Harvey, & Leslie, 1998; Mateja & Otto, 2007). Some faculty members may receive compensation for their research with undergraduates, including travel funds and reassigned time (Perez, 2003).

Barriers of Undergraduate Research for Faculty

According to an evaluation from faculty members at St. Mary's College in Maryland, faculty view undergraduate research "as a very positive experience for their students but mixed for themselves. They value the mentoring relationships but recognize that there is some trade-off in their own scholarship and creative work" (Mervis, 2001, p. 1615). There are many barriers that keep faculty from supervising undergraduate research. Faculty members perceive that research with students may keep them from conducting their own research (Cooley, Garcia, & Hughes, 2008; Elgren & Hensel, 2006) or will not help them with their professional development (Hu et al., 2008; Mervis, 2001). Indeed, research with undergraduates often

does not result in publishable results (Chapman, 2003; Coker & Davies, 2006), which is increasingly important for tenure and promotion decisions (Cooley et al., 2008; Hu et al., 2008). Some disciplines, such as the humanities, do not have a history of involving undergraduates in research (Hu et al., 2008). Undergraduate researchers often need more flexibility with scheduling (Howes et al., 2005) and require more patience from the faculty mentors than do graduate students (Greendyke, 2002, as cited in Hu et al., 2008).

Undergraduates need a great deal of supervision and training, often because they are underprepared for the research in which they are participating (Bowman & Stage, 2002; Chopin, 2002; Coker & Davies, 2006; Hu et al., 2008; McKinney et al., 1998; Perez, 2003). Cox and Andriot (2009) report that students often have a problem seeing "the big picture" of the research projects on which they are working. One school in Maryland had a requirement that all of their students complete a research project before graduation, but they rescinded the requirement after a few years because it was too time-consuming, and students were underprepared (Mervis, 2001). Similarly, students often graduate before being fully trained or finishing their research (Brown, 2001; Coker & Davies, 2006; Zimmer, 2005).

The biggest barrier for faculty in mentoring undergraduate researchers is a lack of time (Brown, 2001; Chapman, 2003; Coker & Davies, 2006; Cooley et al., 2008; Hu et al., 2008; Karukstis, 2004; Mateja & Otto, 2007; McKinney et al., 1998; Perez, 2003; Zydney et al., 2002). Many faculty members do not receive teaching credit for mentoring undergraduate research, nor do they receive any other types of rewards, incentives, or compensation (Baenninger & Hakim, 1999; Hu et al., 2008; McKinney et al., 1998). Faculty members report that they can get their research completed faster if they work alone rather than work with students (Guterman, 2007). As Baenninger and Hakim (1999) noted, "Undergraduate research is a teaching-intensive endeavor requiring serious one-on-one interaction, instruction, and guidance" (p.

8). Cox and Andriot (2009) found that the more time faculty members spend with their students, the better their eventual research abilities, which suggests that a great deal of time is necessary in order to gain the advantages of undergraduate research.

Because there are so many barriers for faculty relative to benefits, some institutions have implemented incentives to increase participation in undergraduate research (Mateja & Otto, 2007; McKinney et al., 1998). For example, faculty stipends, reduced teaching loads, teaching credit, time restructuring, matched funding for external grants, and increased technical support for routine departmental tasks have been implemented in some colleges and universities to increase undergraduate research (Brown, 2001; Elgren & Hensel, 2006; Karukstis, 2004; Mateja & Otto, 2007). Faculty members at universities that do not have these incentives feel that they should be added (Zydney et al., 2002). Elgren and Hensel (2006) note that undergraduate research must advance the faculty member's own research agenda, or else faculty will begin to see undergraduate research as yet another teaching burden. Getting students involved early in their academic careers, during the first or second year, will help faculty members be more productive in the long term because these students can finish more projects and train future undergraduate researchers (Coker & Davies, 2006; Howes et al., 2005; Zydney et al., 2002).

The Present Study

Many of the publications on faculty members' experiences supervising undergraduate research have utilized anecdotal rather than empirical evidence. In the present study, we empirically examined faculty members' experiences with and perceptions of undergraduate research. In addition, we compared faculty who did and did not conduct undergraduate research during the past year. Finally, our study offers more comprehensive views of faculty experiences and views on undergraduate research than most other studies to date. There is little to no research on some of the topics we have

examined. In the present study, faculty members completed an online survey regarding their experiences supervising undergraduate research, including

- past-year experiences, such as the number of students supervised, how they chose the students with whom they worked, and the types of products that emerged;
- the extent to which the students needed to be supervised on various aspects of the research;
- the skills that faculty members believe are obtained in undergraduate research;
- benefits of undergraduate research for faculty members;
- barriers of undergraduate research for faculty members;
- factors that would increase faculty members' participation in undergraduate research.

Participants

The present study was conducted at a large, primarily undergraduate, state university in Georgia. This university does not have an office for undergraduate research. A faculty fellow in the Center for Excellence in Teaching and Learning (CETL) rotates every two to three years to implement undergraduate research initiatives. At the time of the study, a small amount of undergraduate research funding from CETL was available to support conference travel for students and faculty. The funding has since grown to accommodate course reassignments, supplies, and summer stipends. Students present their research at an annual Symposium of Student Scholars, and there is an Undergraduate Research Reception each year honoring all undergraduate researchers and their faculty mentors.

The participants in the present study were 71 faculty members (26 men, 45 women) recruited for an online study. Surveys were sent to all full-time and part-time faculty members at the institution. Participants had between one and 38 years of experience in higher education ($M = 12.60$, $SD = 8.70$). The majority of the participants were assistant professors (43.1%), associate professors

(25.0%), or full professors (19.4%). The most frequently represented colleges were the College of Humanities and Social Sciences (28.2%) and the College of Science and Mathematics (28.2%). The rest of the respondents came from the College of Health and Human Services (12.5%), the College of Business (13.9%), the College of Education (11.1%), and University College (4.2%). The majority of respondents (85.9%) were European American.

Materials

The survey contained questions divided into seven broad categories:

Past-year experiences: The participants answered seven questions about their experiences working with undergraduate students on research projects in the past year. They were asked whether or not they had collaborated with students on research in the past year. Those who responded “yes” answered an additional set of questions about their experiences (see Appendix A for these survey items).

Undergraduate involvement in the research process: Faculty responded to nine items regarding the extent to which students were involved in various aspects of the research process (see Appendix B for these survey items). Responses ranged from 1 (*students do this completely on their own*) to 5 (*students do not participate in this aspect of the research process*). There was also a “not applicable” option for the questions.

Undergraduate research outcomes: Faculty responded to eight items regarding the outcomes of the students’ research projects (see Appendix C for these survey items). Responses ranged from 1 (*students do this completely on their own*) to 5 (*students do not participate in this aspect of the research process*). There was also a “not applicable” option for the questions.

Skills obtained in undergraduate research: Faculty replied to 19 items on the extent to which the students they mentored improved after working with the faculty members on projects (see Appendix D for these survey items). Responses ranged from 1

(*not at all improved*) to 5 (*very much improved*), with “not applicable” as an option.

Benefits: The participants rated nine benefits of working with students on research projects (see Appendix E for these survey items). Responses ranged from 1 (*not a benefit*) to 5 (*very large benefit*).

Barriers: The faculty members rated 11 barriers to mentoring students (see Appendix F for these survey items). Responses ranged from 1 (*not a barrier*) to 5 (*very large barrier*).

Improving undergraduate research opportunities: The final section included 13 items about what would increase faculty participation in mentoring students on research projects (see Appendix G). Responses ranged from 1 (*not at all*) to 5 (*a very large amount*).

Procedure

Faculty members were sent an email with a link to an online survey about undergraduate research. Participants read a cover letter before starting on the survey. All faculty members completed the sections on demographics, benefits, barriers, and improving undergraduate research opportunities. Faculty members who had not supervised research with students in the past year skipped the sections on past-year experiences, undergraduate involvement in the research process, undergraduate research outcomes, and skills obtained in undergraduate research. After completing the survey, faculty members were provided with a debriefing that included more information and links to undergraduate research resources. The survey was designed to be completed in about 20 minutes.

Results

Of the faculty surveyed, 56.3% had worked with undergraduate researchers during the past year. The median number of students with whom faculty conducted research during the past year was four. The modal response was 10 or more students, reported by 17.9% of the sample. Only 53.8% of these faculty members were able to complete all student research projects in one semester. The most common method for

choosing students with whom they worked was students approaching faculty for involvement in existing research projects ($M = 2.36, SD = 1.04$). It was somewhat less common for faculty to approach students to be involved in existing research projects ($M = 2.14, SD = 0.86$), for students to approach a faculty member with their own idea for research ($M = 1.43, SD = 0.60$), or for faculty to approach students to engage in student-generated research projects ($M = 1.43, SD = 0.65$). Students were more likely to work independently on a project than in teams; however, 25.0% of the sample reported that students sometimes worked in teams of five or more. The most common type of credit for research was Directed Study credit. However, almost half of the faculty members had at least one student who volunteered for research without credit or payment. The average amount of time per week that faculty members spent with each student varied considerably, ranging from less than 30 minutes (10.3%) to more than three hours (12.8%). The most frequently reported amount of time was 61 to 90 minutes (33.3%).

Table 1 lists 15 different areas of involvement of students in the research process. Students were most likely to be independently involved in aspects such as data collection and data entry. Students were least likely to be involved in writing and revising manuscripts for publication (almost 61% of respondents do not involve students at all in manuscript revisions). Regarding the early stages of the research process (e.g., designing the study, obtaining IRB approval), it was most common for students to require a great deal of help or not to be involved at all.

Faculty responded to items about the types of products that emerged from the work that they did with undergraduates. Among faculty who had worked with students in the past year on research projects, 45.5% had at least one student present a poster at a regional, national, or international conference, and 41.2% had at least one student who presented a poster at the internal university-wide undergraduate research conference. Fewer participants reported that they had at least one student co-author a submitted

manuscript (33.3%), orally present at a regional, national, or international conference (33.3%), present a poster at an undergraduate conference (26.5%), orally present at the internal university-wide undergraduate research conference (25.7%), orally present at an undergraduate conference (12.5%), or co-author a published manuscript (11.8%). Five participants reported that they were still involved in on-going projects and indicated that some of these products would emerge at a later point.

Faculty rated items about the improvements students made while working on undergraduate research (see Table 2). In general, faculty members rated all items above the midpoint. The biggest improvements occurred in critical thinking and thinking like a scientist.

All faculty members, regardless of whether they supervised undergraduate researchers or not, responded to items regarding benefits of research with undergraduates. In general, the two largest benefits were enjoying supervising undergraduate researchers and preparing students for graduate school (see Table 3). Comparisons of faculty who did and did not supervise undergraduate research during the past year revealed three significant differences. Faculty who did not supervise undergraduates on research were more likely than those who did to report that “students bring new ideas to research” was a bigger potential benefit, $t(61) = -2.42, p = .019$. However, faculty who reported that they supervised research were more likely than those who did not to report that “undergraduate research is viewed positively for merit/annual review” was a bigger potential benefit, $t(60) = 2.12, p = .038$. Faculty who reported that they supervised research were more likely than those who did not to report that “receive credit towards tenure or promotion” was a bigger potential benefit, $t(60) = 2.24, p = .029$.

Table 4 contains the barriers for faculty who had and had not supervised undergraduate research in the past year. The largest barrier listed for all faculty members, whether they currently supervised undergraduate research or not, was that it is

too time consuming. The least important barriers for faculty were that undergraduate research is not valued by their college, colleagues, and department. There were three significant differences between those who did and did not do research with undergraduates during the past year. Faculty who did not supervise undergraduates on research during the past year rated the following three barriers higher than those who did: students are academically unprepared, $t(59) = -2.71, p = .009$; students lack motivation for and commitment to the project, $t(59) = -2.76, p = .008$; and faculty research is not suited to involvement by undergraduates, $t(59) = -2.70, p = .009$.

Table 5 lists factors that would increase faculty participation in undergraduate research. There was generally agreement between faculty who did and did not supervise undergraduate research during the past year. Only one significant difference emerged: Faculty who supervised undergraduates rated “reassigned time” as a factor that would increase their participation in undergraduate research more than those who did not supervise students, $t(59) = 2.21, p = .031$. The most highly rated factors included teaching credit and summer stipends for faculty. The factors rated lowest by faculty were faculty learning communities and workshops for faculty.

For most sections, respondents were allowed to add comments. Many of the comments focused on the problems that faculty encounter when supervising undergraduate research:

- In the lab sciences, it is unrealistic to expect that undergraduate students can review the literature and design a project for which the professor is expected to publish with national recognition....There is a genuine value in giving undergraduates the space to come up with their own higher level hypotheses (“critical thinking” is the jargon I believe). But unfortunately, again, requirements for publication and national recognition exclude undergraduate-led research (*female math/science professor*).

- I would prefer and enjoy spending more of my time training undergraduates to help prepare them for work or graduate studies. However, such work is VERY undervalued. Faculty members taking on research students do so over and above their normal duties. Emphasis is placed on publications. Training multiple undergraduates, who only work on the project for a small amount of time, impedes the production of publishable research (*male math/science professor*).

Two faculty members commented on the amount of time required to supervise undergraduates:

- What I need is time. I get zero teaching credit (course load reduction) for what is far and away the most time-consuming teaching aspect of my job (*male science/math professor*).
- Although I have supervised [many] undergraduates in research, I am going to have to cut back. I am no longer able to keep up with so many each semester and stay organized. I would have to have teaching credit or reassigned time to continue to work at this level (*female humanities/social sciences professor*).

Discussion

This study represents one of the most comprehensive studies to date on faculty experiences with and perceptions of undergraduate research. Many of the findings are consistent with past research. For example, in our study, most students approached faculty members and asked to be involved with research (Zydney et al., 2002). We found that the biggest barrier for faculty was that undergraduate research was too time consuming (Brown, 2001; McKinney et al., 1998; Perez, 2003; Zydney et al., 2002). Another common barrier was that students are underprepared for research (Bowman & Stage, 2002; Chopin, 2002; Coker & Davies, 2006; Hu et al., 2008). Faculty in our study reported that students often graduate before completing the research (Brown, 2001; Coker & Davies, 2006; Zimmer, 2005). Faculty in our study reported wanting incentives that were similar to incentives implemented in other

studies (Brown, 2001; Elgren & Hensel, 2006; Karukstis, 2004). We found that skills gained by students, such as critical thinking, thinking like a scientist, and data entry, were similar to gains found in other studies (Cox & Andriot, 2009; Kardash, 2000; Lopatto, 2003). Also, similar to past research (Cox & Andriot, 2009; Hunter et al., 2006; Kardash, 2000), faculty in our study rated students' ability to write papers for publication lower than other skills. Few students who participate in undergraduate research are getting the opportunity to present their findings at professional conferences or in publications (Hunter et al., 2006). The biggest benefit in our study was personal satisfaction and enjoyment (Cech, 2003; Chopin, 2002; Hunter et al., 2006; Zydney et al., 2002).

Although other researchers have found that undergraduate research can help with tenure and promotion (Leslie et al., 1998; Mateja & Otto, 2007), faculty members in our study rated this as one of the smallest benefits. Overall, there is little research on the number of students whom faculty members supervise in a year; our results indicate that faculty members in our study may be supervising more undergraduate researchers than at other universities (Zydney et al., 2002). There is no existing research in which there are comparisons of faculty who do and do not supervise students in undergraduate research. In our study, both groups generally listed similar barriers, benefits, and factors that would increase their participation.

The biggest limitation of this study was that faculty members from particular disciplines were underrepresented. Although the call for responses went out to all faculty members on the campus, and although the title was "Assessment of Undergraduate Scholarship and Creative Activities," there were few responses from faculty in the humanities and none from faculty in the arts. All of the survey items that were geared

toward non-scientific research/creative activities were answered with "not applicable" by the faculty who did respond.

Researchers have begun calling for more focus on undergraduate research in non-STEM (science, technology, engineering, and math) fields (Grobman, 2007; Levenson, 2010; Schantz, 2008). There is little research specifically devoted to this population; future researchers should examine their experiences in more depth. For example, are the benefits and barriers to undergraduate research different for faculty in other disciplines? Is it more difficult to train multiple undergraduates in the humanities versus the laboratory sciences? What can directors of undergraduate research do to increase participation by these underrepresented disciplines?

Most studies on undergraduate research have been focused on the students' experiences. More research is needed from the faculty perspective to increase the amount and quality of undergraduate research being conducted at universities. For example, a number of studies have shown differential experiences for underrepresented groups in academia. Kuh et al. (2007) found that male students engaged in more research than female students. Special consideration may be needed for students who may feel alienated in academic settings (nontraditional students, first-generation college students, women in STEM fields; Bowman & Stage, 2002; Hu et al., 2008). Zimmer (2005) found that many students from underrepresented groups and first-generation students feel hesitant about taking up their professors' time (Zimmer, 2005). Future researchers could examine the extent to which faculty members are aware of these issues and whether they create undergraduate research experiences that meet the needs of these underserved populations. Many institutions have implemented undergraduate research models that address some of these issues (Hu et al.,



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2008); future researchers could examine faculty perceptions of these efforts.

Many of the publications in this area involve anecdotal evidence rather than research. Future examinations of undergraduate research experiences should be empirically based. More research is needed on the actual experiences that faculty have. For example, how many students do faculty members supervise in a year? Do they think that number is too high or too low? How much time do faculty members spend with each undergraduate researcher? Are they satisfied with the amount of time they spend in undergraduate research supervision? Are faculty members working with teams of students or individuals? What prevents faculty from creating research teams? Do research teams save time or create more work for the faculty member? How many products (publications, presentations) emerge from undergraduate research collaborations, and are faculty satisfied with the number and quality of those products?

Several encouraging findings have emerged from this study. For example, faculty members in general perceived that undergraduate research was valued by their colleagues and their departments. There seemed to be a general agreement that supervising undergraduate researchers is enjoyable, and faculty members rated students as improving in a number of research-related skills. However, the overall picture that emerged from this research was that of an overtaxed faculty member who sees value in undergraduate research but who has too many professional commitments, too many research pressures, and not enough time. Most students worked individually on research projects, and many took multiple semesters to complete their work.

The research suggests that the best undergraduate research experiences involve

the faculty members spending a great deal of one-on-one time with their students, taking them to professional conferences, involving them in the research in meaningful ways (i.e., they should not simply engage in “grunt work”), and conducting regular meetings with them (Hunter et al., 2006; Kuh et al., 2007; Lancy, 2003; Shellito, Shea, Weissmann, Mueller-Solger, & Davis, 2001; Thiry & Laursen, 2009; Zimmer, 2005). Obviously, these strategies will result in a great learning experience for the students, but they may also result in burnout for the faculty mentors over time. The big issue for scholars in this area will be to figure out how to balance the needs of the students with the needs of the faculty mentors. Many of the “best practices” in the literature address issues that would improve the undergraduate research experience for students; however, ideas are needed for the many professional issues that faculty face (time, money, publication pressures). There is little research on strategies for addressing these barriers, although some have advocated for a better integration of teaching, research, and service and a reorientation toward viewing undergraduate research as facilitating faculty research agendas rather than hindering them (Clark, 1997; Colbeck, 1998; Karukstis, 2004).

It is important to address issues that faculty face before addressing issues that students face because if faculty members do not have time or funding, they may not be able to continue to supervise undergraduate researchers. The faculty members in this study have clearly delineated the factors that would increase their involvement in undergraduate research; will administrators pay attention? If administrators are serious about increasing undergraduate research, then they need to start implementing the strategies that will entice faculty to participate.

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Table 1
Amount of Independence in Steps of the Research Process

Areas of involvement	Mean	SD	<i>n</i>	Percent of faculty who do the task themselves
Entering data into a spreadsheet	2.21	0.92	28	0.0%
Creating spreadsheet to enter data	2.40	1.04	25	4.0%
Collecting data	2.53	0.86	30	0.0%
Creating presentation (undergraduate conference)	2.88	0.73	25	0.0%
Creating presentation (general audience)	2.93	0.73	14	0.0%
Locating references on the topic	3.00	0.89	34	2.9%
Creating written product (general audience)	3.33	0.65	12	0.0%
Evaluating/synthesizing past research on topic	3.45	0.75	33	6.1%
Creating presentation (professional conference)	3.48	0.77	25	8.0%
Analyzing data	3.63	0.87	32	9.4%
Coming up with topic area or idea	3.91	1.10	33	39.4%
Designing the study	3.94	0.85	31	22.6%
Completing the IRB approval form	3.95	1.13	22	40.9%
Writing up research for publication	4.11	0.80	27	25.9%
Revising a manuscript after feedback	4.48	0.90	23	60.9%

Note. Ratings were based on a five-point scale: 1 (*students do this completely on their own*), 2 (*with only a little bit of help from me*), 3 (*with a moderate amount of help from me*), 4 (*with a great deal of help from me*), and 5 (*the students do not participate in this aspect of the research; I do it myself*). Sample sizes differed because not all questions were applicable to every participant (out of a possible 41 faculty members who supervised undergraduate research in the past year).

Table 2
Skills Improved for Undergraduates Who Engage in Undergraduate Research

Skill	Mean	SD	<i>n</i>
Working independently	3.39	1.17	28
General writing skills	3.48	0.91	29
Summarizing/synthesizing past research	3.48	1.06	29
Getting along with people who are different	3.50	1.10	20
Oral communication skills	3.55	0.96	31
Using technology and computer programs	3.58	0.90	26
Locating past research on a topic	3.57	0.92	28
Evaluating past research on a topic	3.63	1.04	27
Research design	3.70	0.93	23
Thinking creatively	3.73	0.98	30
Understanding the ethics of research	3.79	1.10	28
Data analysis	3.82	0.86	28
Data interpretation	3.86	0.92	29
Data entry	3.88	0.90	24
Formulating a hypothesis	3.91	0.90	23
Thinking like a scientist	4.07	0.86	28
Critical thinking	4.16	0.86	31

Note. Ratings were based on a five-point scale: 1 (*not at all improved*), 2 (*a little bit improved*), 3 (*somewhat improved*), 4 (*a good deal improved*), and 5 (*very much improved*). Sample sizes differed because not all questions were applicable to every participant (out of a possible 41 faculty members who supervised undergraduate research in the past year).

Table 3
Benefits for Faculty of Supervising Undergraduate Research

Benefit	Supervised undergraduates	
	Yes	No
Enjoy teaching students about research	3.94 (0.98)	3.86 (0.97)
Able to prepare students for grad school	3.76 (0.96)	3.76 (1.06)
Able to prepare students for work experience	3.55 (1.09)	3.66 (1.08)
Able to work one-on-one with a student	3.42 (0.87)	3.55 (1.06)
Receive help from undergrads on research	2.97 (1.38)	3.14 (1.13)
Students bring new ideas to research*	2.50 (1.19)	3.24 (1.24)
Viewed positively for merit/annual review*	3.21 (1.11)	2.62 (1.08)
Receive credit toward tenure*	2.76 (1.17)	2.10 (1.11)

Note. Ratings were based on a five-point scale: 1 (*not a benefit*), 2 (*small benefit*), 3 (*moderate benefit*), 4 (*large benefit*), and 5 (*very large benefit*). Means are reported next to each item with standard deviation in parentheses.

* $p < .05$.

Table 4
Barriers to Faculty for Supervising Undergraduate Research

Barrier	Supervised undergraduates	
	Yes	No
Time consuming	3.59 (1.13)	3.75 (0.93)
Students are underprepared**	2.76 (1.21)	3.59 (1.15)
Students lack motivation**	2.50 (1.08)	3.30 (1.17)
Low-quality research	2.79 (1.41)	3.00 (1.18)
Students graduate before finishing	2.59 (1.26)	2.58 (1.36)
Research not suitable for undergrads**	1.85 (1.10)	2.70 (1.35)
Does not help with tenure/promotion	1.94 (1.30)	2.41 (1.37)
Not valued by my college	2.06 (1.39)	2.19 (1.18)
Not valued by colleagues	1.76 (1.18)	2.30 (1.10)
Not valued by department	1.85 (1.23)	2.19 (1.11)

Note. Ratings were based on a five-point scale: 1 (*not a barrier*), 2 (*small barrier*), 3 (*moderate barrier*), 4 (*large barrier*), and 5 (*very large barrier*). Means are reported next to each item with standard deviation in parentheses.

* $p < .05$.

** $p < .01$.

Table 5
Factors That Would Increase Faculty Participation in Undergraduate Research

Factor	Supervised undergraduates	
	Yes	No
Teaching credit for supervising undergraduates	4.26 (1.08)	3.74 (1.10)
Summer stipends for faculty	4.09 (1.26)	3.59 (1.34)
Reassigned time for supervising undergraduates*	4.03 (1.14)	3.37 (1.18)
Students are better prepared for research experiences	3.59 (1.31)	3.50 (1.10)
Reduced service obligations	3.27 (1.18)	3.32 (1.25)
Summer stipends for students	3.15 (1.44)	3.27 (1.12)
Increased funding for student travel to conferences	3.24 (1.26)	3.08 (1.09)
Increased funding for faculty travel to conferences	3.24 (1.35)	3.04 (1.15)
Increased funding for supplies	3.06 (1.25)	2.77 (1.37)
Involving students in research earlier	2.94 (1.32)	2.72 (1.21)
Workshops for students on undergraduate research	2.58 (0.97)	3.00 (1.27)
Faculty learning communities on undergraduate research	2.26 (1.21)	2.54 (1.45)
Workshops for faculty on undergraduate research	2.18 (0.94)	2.41 (1.31)

Note. Ratings were based on a five-point scale: 1 (*would not increase at all*), 2 (*would increase a small amount*), 3 (*would increase a moderate amount*), 4 (*would increase a large amount*), and 5 (*would increase a very large amount*). Means are reported next to each item, with standard deviation in parentheses. Faculty learning communities refer to groups of six or fewer faculty members who receive funding to focus on a teaching/learning concept.

* $p < .05$.

Appendix A

Past-Year Experiences

1. How many different undergraduate students did you work with on scholarship or creative activity during this time? *(Response options ranged from 1 to 10 or more)*
2. How many of these students completed the work within one semester? *(Response options ranged from 1 to 10 or more)*
3. Consider your experiences supervising undergraduate students on scholarship or creative activity during the past year. How did you choose the students with whom you worked? *(Response options ranged from 1-never to 4-always)*
 - a. Students approached faculty with an idea about research.
 - b. Students approached faculty to help with an existing project.
 - c. Faculty approached students to be involved in their own projects.
 - d. Faculty approached students to be involved in faculty projects.
 - e. Other (please specify).
4. Consider your experiences with undergraduate students as collaborators on scholarship or creative activity over the past year. In general, did the students collaborate with each other on the same projects or did they work independently? *(check all that apply)*
 - a. Some students worked independently on a project.
 - b. Some students worked in teams of two.
 - c. Some students worked in teams of three.
 - d. Some students worked in teams of four.
 - e. Some students worked in teams of five or more.
 - f. Other (please specify).
5. When you worked with undergraduate students on scholarship or creative activity during the past year, what kind of credit did the students get for their work? *(check all that apply)*
 - a. At least one student earned Directed Study credit.
 - b. At least one student earned course credit (not a Directed Study).
 - c. At least one student was paid for research work.
 - d. At least one student did not earn credit or money for research work (e.g., volunteered to work on a research project).
 - e. Other (please specify).
6. During the past year, approximately how much time did you spend per week meeting with each undergraduate student whom you supervised on scholarship or creative activity? *(Response options ranged from less than 30 minutes to more than 3 hours per week)*
7. When you worked with undergraduate students on scholarship or creative activity during the past year, what kind of products emerged from the work? *(check all that apply)*
 - a. At least one student presented a poster at the KSU Symposium of Student Scholars.
 - b. At least one student did an oral presentation at the KSU Symposium of Student Scholars.
 - c. At least one student presented a poster at a conference for undergraduate researchers.
 - d. At least one student did an oral presentation at a conference for undergraduate researchers.

- e. At least one student presented a poster at a regional, national, or international conference.
- f. At least one student did an oral presentation at a regional, national, or international conference.
- g. At least one student is an author or co-author of a manuscript submitted for publication (not yet published).
- h. At least one student is an author or co-author of a published research paper.
- i. At least one student was involved in an art/music/theater exhibit or performance.
- j. Other (please specify).

Appendix B

Undergraduate Involvement in the Research Process

Responses ranged from 1 (*students do this completely on their own*) to 5 (*students do not participate in this aspect of the research process*). There was also a “not applicable” option for the questions.

1. Coming up with the topic area/idea.
2. Locating relevant references or other resources on the topic.
3. Evaluating and synthesizing past research on the topic.
4. Designing the study (e.g., creating questions, coming up with the procedure).
5. Completing the IRB Approval Request form.
6. Collecting data.
7. Creating a spreadsheet (e.g., in SPSS or Excel) to enter data.
8. Entering the data (e.g., into a spreadsheet program like SPSS or Excel, typing up participant responses, transcribing interviews).
9. Analyzing the data.

Appendix C

Undergraduate Research Outcomes

Responses ranged from 1 (*students do this completely on their own*) to 5 (*students do not participate in this aspect of the research process*). There was also a “not applicable” option for the questions.

1. Creating a poster/oral presentation for an undergraduate research conference (including the Symposium of Student Scholars).
2. Creating a poster/oral presentation for a regional, national, or international conference.
3. Creating a presentation/workshop/program for a general audience.
4. Creating a written product for a general audience (e.g., a website, newspaper, or magazine article).
5. Involvement in theatrical/artistic productions (e.g., paintings, sculpture, dance concerts, theater performances, performance art pieces, story-telling performances, poetry readings, music concerts, sounds/lights/costumes/sets for theater performances, choreography).
6. Writing up the research for publication (e.g., journal article, book, book chapter).
7. Revising a manuscript after feedback from reviewers.
8. Other (please specify).

Appendix D

Skills Obtained in Undergraduate Research

Responses ranged from 1 (*not at all improved*) to 5 (*very much improved*), with “not applicable” as an option.

1. Research design
2. Formulating a hypothesis
3. Data entry
4. Data analysis
5. Data interpretation
6. Critical thinking
7. Thinking like a scientist
8. Thinking creatively
9. Understanding the ethics of research
10. Locating past research on a topic
11. Evaluating past research on a topic
12. Summarizing and synthesizing past research on a topic
13. Oral communication
14. General writing skills
15. Getting along with people who have different backgrounds, attitudes, or opinions
16. Using technology and computer programs
17. Working independently
18. Skills related to art/theater/music/dance
19. Other scholarship/creative activity skills gained by undergraduate researchers (please specify)

Appendix E

Benefits

Responses ranged from 1 (*not a benefit*) to 5 (*very large benefit*).

1. I get the opportunity to work one-on-one with a student.
2. I receive help from undergraduates with my scholarship/creative activities.
3. Students bring new ideas to my scholarship projects/creative activities.
4. Undergraduate scholarship/creative activity is viewed positively for merit/annual review.
5. I receive credit toward tenure and/or promotion.
6. I am able to help students be better prepared for graduate studies.
7. I am able to help students be better prepared for work experiences.
8. I enjoy teaching students about scholarship/creative activities.
9. Other benefits (please specify).

Appendix F Barriers

Responses ranged from 1 (*not a barrier*) to 5 (*very large barrier*).

1. Supervising undergraduate scholarship/creative activity projects is time-consuming.
2. Scholarship/creative activity by undergraduates is often of low quality.
3. Scholarship/creative activity by undergraduates is not valued by my colleagues.
4. Scholarship/creative activity by undergraduates is not valued by my department.
5. Scholarship/creative activity by undergraduates is not valued by my college.
6. Scholarship/creative activity by undergraduates does not help me with my annual review, tenure, and/or promotion.
7. It is difficult to find undergraduate students who are academically prepared for scholarship/creative activities.
8. Undergraduate students often lack motivation for and commitment to the project.
9. Students often graduate before finishing their scholarship/creative activity projects.
10. My scholarship/creative activity is not suited to involvement by undergraduates.
11. Other barriers (please specify).

Appendix G

Improving Undergraduate Research Opportunities

Responses ranged from 1 (*not at all*) to 5 (*a very large amount*).

1. Increased funding by KSU for student travel to conferences.
2. Increased funding by KSU for faculty travel to conferences.
3. Summer stipends for students who participate in undergraduate scholarship/creative activity.
4. Summer stipends for faculty who supervise undergraduate scholarship/creative activity.
5. Faculty learning communities devoted to undergraduate scholarship/creative activity.
6. Workshops for faculty members related to undergraduate scholarship/creative activity topics (e.g., good mentoring practices, increasing students' research skills).
7. Workshops for students related to undergraduate scholarship/creative activity topics (e.g., an overview of the research process, a statistics review).
8. Reduced service obligations for supervising undergraduate scholarship/creative activity.
9. Reassigned time for supervising undergraduate scholarship/creative activity.
10. Teaching credit for supervising undergraduate scholarship/creative activity (e.g., a set number of research supervisions would count as a course).
11. Involving students in scholarship/creative activity earlier in their academic careers (e.g., during their first or second years).
12. Students who are better prepared for scholarship/creative activity experiences (e.g., increased knowledge of research design, increased knowledge of statistics, better writing skills).
13. Other (please specify).