Due to the ability of undergraduate research programs to prepare successful students, there has been a clarion call for the creation and expansion of these programs at learning institutions ranging from small primarily undergraduate colleges to large research universities (American Association for the Advancement of Science, 2011; Boyer Commission on Educating Undergraduates in the Research University, 1998; National Research Council, 2003). The benefits of these types of programs to the institutions, the faculty, and most importantly, the students are well documented. For example, Nagda, et al. (1998) showed that student involvement in research programs leads to increased student retention. The work further showed that retention improved for students that were at the greatest risk for attrition. Several studies have shown that there is an increase in the pursuit of graduate and professional degrees by students that have had opportunities for research as undergraduates (Bauer and Bennett, 2003; Hathaway et al., 2002). Lastly, many studies have illustrated the overall enhanced educational experiences for students participating in research (Bauer and Bennett, 2003; Kardash, 2000; Lopatto, 2004; Seymour et al., 2004; Zydney et al., 2002).

Evidence demonstrating the efficacy of undergraduate research is provided primarily by established and well-funded undergraduate research programs, often supported through large grants or endowments that finance student stipends, research funds, and related activities (Butler et al., 2008; Frantz et al., 2006; Junge et al., 2000; Kardash, 2000; Nagda et al., 1998; Thiry et al., 2012; Zydney et al., 2002). Many small, primarily undergraduate institutions may find it difficult and unsustainable to support similar initiatives at a comparable funding level because of the priority on teaching over external research funding. This was the case in the College of Arts and Sciences at Widener University, a private metropolitan university with a diverse student body predominantly from the greater Philadelphia area. In an effort to provide our undergraduates with some of the benefits attributed to these well-funded programs, we created the Arts and Sciences Summer Research Program (SRP) in 2009. The SRP provided community building and professional development events for summer undergraduate researchers at Widener on a modest budget. Previous research has demonstrated the importance of these types of activities in participant satisfaction in summer research programs (Grimberg et al., 2008). Through the SRP, significant gains in
student and faculty involvement in undergraduate research and the creation of an undergraduate research community were made possible on a limited budget. We present the Widener Arts and Sciences Summer Research Program from the perspectives of the program directors and the student researchers in order to provide a model for the formation of summer research programs under tight budgetary constraints.

Program Directors’ Perspectives

Founded in 1821, Widener University is comprised of eight schools and colleges that offer degrees in the liberal arts and sciences as well as professional programs such as engineering and nursing for approximately 5000 students on the main campus in Chester, Pennsylvania. The College of Arts and Sciences enrolls approximately 900 undergraduate students and less than 50 graduate students, operating primarily as a small undergraduate liberal arts college. Many of our undergraduates are first generation college students and 90% of all students receive financial aid.

Experiential learning and civic engagement are central to the University’s mission. Undergraduate research has a long tradition in the sciences and is considered an integral part of undergraduate education. During the academic year, students may participate in research as part of a course, an independent research project, or a senior research thesis. Prior to the establishment of the SRP, summer research was a limited part of that tradition, and data on participation of students in summer research were not kept before 2007. During that time participation varied greatly and was limited, for the most part, to the sciences. There was little institutional funding for summer research and the limited available support drew mainly from the operating budget of the sciences.

However, interest in the increased availability of summer research opportunities was growing, as it provided research opportunities for students who were unable to participate during the school year due to heavy course loads or work schedules. In 2007, as part of the University’s Strategic Plan, a summer housing program was established for undergraduate researchers to provide students with low or no cost housing in campus dormitories. This was financially supported by the Office of the Provost and the Dean of the College of Arts and Sciences to help expand summer research. In 2007 and 2008, fourteen or fewer College of Arts and Sciences undergraduate students participated in summer research each year (Table 1, below). Despite low participation levels, the college was fertile ground for the inception of a more formalized summer research program. Coupled with increasing expectations for faculty involvement in undergraduate research, the Arts and Sciences Summer Research Program was quickly able to take root and grow.

Prior to the SRP, faculty and students tended to be isolated in their laboratory groups and departments, and there were few opportunities for faculty and student researchers to gather informally. We felt that a crucial part of the undergraduate research experience was the opportunity for research students to meet and discuss their experiences with their peers and with faculty researchers. The SRP was founded in 2009 in an attempt to broadly engage summer undergraduate researchers in a dynamic research community consisting of both students and faculty. Beginning as a series of six community building activities during the summer months, the program provided opportunities for informal student-student and student-faculty interactions. Starting with a small budget of $250 the first year to support activities for 15 students, we arranged three...
student–faculty group lunches (pizza provided), a movie night in a lecture hall, an ice cream social with liquid nitrogen ice cream, and an evening event roasting marshmallows over a grill with a private stargazing session at the Widener telescope (Table 2, below). These activities took advantage of the resources already existing at Widener and required a minimal investment of time from other faculty and the students. We experienced very positive feedback from students and faculty and a high level of interest in the continuation of the program.

<table>
<thead>
<tr>
<th>Year</th>
<th>Faculty collaborating with undergraduates</th>
<th>Faculty collaborating with more than 2 undergraduates</th>
<th>Student researchers</th>
<th>Total Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>8</td>
<td>2</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>2008</td>
<td>6</td>
<td>1</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>2009</td>
<td>10</td>
<td>2</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>2010</td>
<td>19</td>
<td>8</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>2011</td>
<td>17</td>
<td>7</td>
<td>29</td>
<td>46</td>
</tr>
<tr>
<td>2012</td>
<td>22</td>
<td>6</td>
<td>33</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 1. On-campus participation in summer undergraduate research in the College of Arts & Sciences at Widener University from 2007-2012. The Arts & Sciences Summer Research Program was initiated in 2009 and has continued to the present.

<table>
<thead>
<tr>
<th>Year</th>
<th>SRP Funding*</th>
<th>Cost per participant</th>
<th>Number of Events</th>
<th>Cost per participant per event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$250</td>
<td>$10.00</td>
<td>6</td>
<td>$1.66</td>
</tr>
<tr>
<td>2010</td>
<td>$950</td>
<td>$21.59</td>
<td>12</td>
<td>$1.80</td>
</tr>
<tr>
<td>2011</td>
<td>$2100</td>
<td>$45.65</td>
<td>15</td>
<td>$3.04*</td>
</tr>
<tr>
<td>2012</td>
<td>$2650</td>
<td>$48.18</td>
<td>15</td>
<td>$3.21*</td>
</tr>
</tbody>
</table>

*SRP funding costs do not include student summer housing costs 
*Cost increase attributed primarily to expanded summer research symposium

Table 2. Costs of Arts and Sciences Summer Research Program events 2009-2012.

In 2010, we were able to build on the previous year’s success and expand the SRP events to include professional development activities. We knew that undergraduate research experiences would help our students succeed in applications to graduate schools, professional schools, and in entering the workforce. However, many of our students lacked skills in other areas crucial to these endeavors. We knew that the summer was an opportune time to provide information sessions and panel discussions on career development, as well as expanding the community building elements of the program. We expanded the SRP activities to include career development sessions led by the program directors on applying to graduate school, interviewing for a job, and designing a research poster. We also provided community building activities including the original six events, tie-dying t-shirts, and a faculty-student water balloon fight. The career building and community development events were accompanied by lunch and informal networking between students, faculty, and alumni. The program culminated in the first
The research community created through the SRP provided a center for discussion, learning, and collaboration that was able to encompass the diversity of student and faculty interests and activities.
departmental or college level depending on the institutional needs.

We hope to continue to expand student and faculty participation in the SRP at Widener through increased recruitment efforts. We continue to welcome students and faculty in new areas of research each summer and to explore new avenues for long term funding. Increased participation may require minor modifications of some events if funding does not increase, but the essential community of summer scholars will endure.

**Undergraduate Researchers’ Perspectives**

In order to include a variety of student perspectives, we vary in our backgrounds and in our level of involvement in the SRP. Our fields of study cover biology, biochemistry, and chemistry, and we represent commuters, academic year dormitory residents, and summer housing program residents. As a group, our participation in the SRP ranged from 1-3 summers, with at least one student providing perspectives from each year of the program’s existence. Each of us became involved in the program for different reasons, including faculty recommendations, personal curiosity in exploring undergraduate research, or gaining hands-on experience in research due to its high attractiveness to graduate/professional programs and potential employers.

Overall, the SRP provided us with more involvement in rigorous experimentation than would be possible during the semester. At larger institutions, undergraduates are often trained by graduate or post-doc mentors. Since Widener does not have a graduate program in any of our fields, we are trained by more senior undergraduates or directly by our advisor. This also poses difficulty during the normal academic year when arranging times where both the mentor and trainee are available. With a more open schedule during the summer, we could be trained in more areas than would otherwise be possible in the academic year. In most cases, the work we completed during our first summer research opportunity led to significant results that motivated us to continue research and/or use it as a starting point for a senior thesis. In addition, some of us worked on projects requiring field work. During the semester, only 15 weeks are available, half of which there is snow on the ground, making it difficult to ask certain types of ecological questions. During the SRP, we were able to have a full field season and work with species not available during the academic year.

Although most of us were not expected to perform research full time, we developed relationships with our peers and advisors or an intensified interest in our work, which made it desirable to be in the lab as much as possible. Additionally, some of us had taken research credits over the summer, and a specified number of research hours were required. This was met with ease during the SRP, as opposed to arranging experiments around classes, coursework, and other commitments during the academic year. In addition to summer research, there was time available for several of us to take summer courses or to hold other part time jobs. Nonetheless, our time commitment was primarily on our own accord, but we feel that we either met or exceeded any expectations of our advisors.

In addition to research during the SRP, we also had the opportunity to attend each of the events sponsored by the program. During our first year, the majority of us attended all events that matched our availability. After this first year, we chose which academic events to attend based on the relevance to our future interests, since we already had an understanding of the content of the events. We generally attended the majority of social events to meet, network, and build bonds with our peers and faculty. In addition, the events were conveniently held over the lunch hour each week, providing the incentive of free food.

Many of the SRP activities are intended to prepare students for future professional endeavors. We found events such as resume building sessions, mock interviews, and question and answer sessions with Widener alumni about professional preparation and post-graduate experiences highly useful as we approached our graduation dates. The resume and CV building session was particularly
useful as it covered discipline-specific requirements. Other similar events on campus during the academic year are designed for a general audience and therefore are of limited usefulness for science specific terminology and conventions. Many of us who were applying to graduate school were able to create CVs and have them evaluated by our summer research mentors. Students joining the work force were taught how to properly create a one page resume, highlighting those aspects important to industry.

Throughout the summer, the program had a profound effect on our relationships with faculty and with our peers. All student and faculty members of the SRP were invited to each event, and downtime was provided for informal interactions and conversations. During this time, we had the opportunity to speak with faculty and students that we did not previously know. As a result, we built bonds with faculty members from outside of our departments, as well as professors we would take courses from during later semesters. Having previously established relationships with our professors increased our comfort level in approaching them when we required further explanation about coursework outside of regularly scheduled class time. In addition, we feel that being familiar with our professors after meeting them during the SRP has increased our motivation to excel academically. The relationships we built with our research advisors and other faculty in the SRP were important in forming our senior research thesis committees and seeking troubleshooting advice in our research projects throughout the academic year. When we applied for graduate or professional programs or jobs, our SRP contacts were invaluable in finding faculty to write recommendation letters and providing feedback on personal statements. Many of us feel that the experiences we’ve had and the relationships we formed were responsible for the directions we have taken upon graduating. Those of us who have continued on to professional/graduate programs feel that none of this would have been made possible without the summer research program and the relationships and experiences it has afforded us.

The graduate school workshop with Widener alumni familiarized us with the application and interview process, and provided advice on selecting a school and a graduate research advisor. For many of us, this was the first exposure to current graduate students’ perspectives on post-Widener education. This offered a contrast to faculty perspectives on graduate school requirements and experiences. Those of us who chose to join the workforce after graduation found the research experience crucial to their job searches. The skill sets we learned through summer research, such as teamwork, time management, and problem solving, were helpful in finding a position.

We also built peer relationships with other motivated students during the SRP events. This is particularly true for those of us that commuted during the academic year. As commuters, students often have a limited peer network and may not be able to engage in on-campus events frequently. This network was expanded through meeting others who share the common interest of research during the SRP. During future courses, the commuters found themselves less excluded from the student social community and were more readily able to form study groups with other SRP students. We also had the opportunity to build peer relationships with students from fields of study outside of science. This provided us with a broader connection to the research community in the College of Arts and Sciences and allowed us to learn about research in a broad range of fields. Additionally, we formed friendships with students outside of our majors and outside of our year groups. Our transition into upper division, major specific courses was easier, because we already knew some of the students outside of our academic year through the SRP. We also found familiar faces in our general education courses from the SRP peer group.

Participating in the end of summer SRP symposium provided us with an opportunity to learn to effectively communicate scientific research and increase our confidence in
future presentations. One of the summer sessions included an instructional presentation on how to design a poster in preparation for the end of summer symposium. During the academic year, we may have the opportunity to design and present a poster for coursework or professional meetings, but typically have limited instruction on how to do so. The combination of the poster design workshop and symposium effectively equipped us with the skills necessary to successfully present at national and regional conferences. This has led to several SRP students earning presentation awards at regional and national conferences and having increased confidence when compared to some of our peers who did not have this opportunity. The SRP symposium provided a supportive environment to gain experience in presenting our research, and in some cases we felt it was more useful in developing our presenting skills than external conference experiences due to the higher volume of audience interactions. The skills we developed in the SRP are valuable in future academic and professional environments.

Conclusions
This paper shares a model by which many of the advantages provided by established and well-funded summer research programs can also be achieved by a small program working with a tight budget. We focused our efforts on providing low-cost community building activities and tapping existing University resources for professional development events. We experienced a dramatic increase in student and faculty participation in summer research during the first four years after the creation of the SRP. Summer research students reported gains in professional skills and stronger relationships with peers and faculty. We expect future increases in student participation to be primarily limited by funding, as many of our students are unable to participate as unpaid summer research volunteers. Increased institutional and external funding to support student stipends, housing, research supplies, and faculty salary could result in tremendous future program growth. Through the SRP, we have learned that summer programming does not need to be expensive to be effective. The essential element is bringing the student and faculty together, where expertise can be shared and relationships built.

Acknowledgements
We would like to thank the student and faculty participants of the A&S SRP for making the program a success, and Dr. Jo Allen and Dr. Stephen Wilhite for their support of summer research at Widener University. We would also like to thank the anonymous reviewers for providing useful feedback and help in improving this manuscript.
Appendix A: Widener University Arts & Sciences Research Program Activities

**Community Building Events**
- **“Meet the summer research students” event**: Student and faculty participants give informal introductions and network over pizza lunch.
- **“Taking advantage of opportunities” discussion**: Faculty and students discuss ways of making the most of the summer research experience over pizza lunch.
- **Liquid nitrogen ice cream party**: Students make liquid nitrogen ice cream and lead a program t-shirt design discussion.
- **“Research as art” discussion**: Humanities faculty lead discussion on the relationship between photography, research, and art over a pizza lunch. Discussion is based on photographs and other images supplied by students and faculty.
- **Stars and s’mores**: Students, faculty, and alumni build community, network, toast marshmallows over a grill, and eat s’mores on campus while having a private viewing of the stars at the Widener telescope led by a science faculty member.
- **Water ice and water balloons**: Faculty and students participate in a water balloon fight with water ice for dessert.
- **Ice cream socials** (1-2 per semester, scheduled when low attendance is expected)
- **Tie-dye t-shirts**: Students and faculty tie-dye supplied white t-shirts and other items of clothing such as lab coats with the Sharpie Pens tie-dying method.

**Professional Development Pizza Lunch Events**
- **Resumes, CVs, and job searches panel**: Alumni panel discusses CV- and resume building-skills and the job search process with students. The panel includes recent SRP alumni who completed successful job searches and alumni with established careers. A question-and-answer period provides an opportunity for networking.
- **Thinking about graduate school panel**: Panel of SRP alumni who are currently in graduate programs discuss the graduate school application process and their experiences in graduate programs. A question-and-answer period provides an opportunity for networking.
- **Mock interviews**: An invited speaker from the career center talks about the interviewing process. Students have the opportunity to ask questions and to arrange mock interviews on a rolling basis, often during the following academic year.
- **“How to build a poster” session**: Faculty present on poster building basics to prepare students for the summer research symposium.
- **Ethics events**: Two ethics training workshops are hosted by the Oskin Leadership Institute at Widener University as well as an additional faculty-led discussion on ethics in research.
- **“What is success?” discussion**: Faculty-led discussion helps students reflect on summer experiences by considering the meaning of success vs. failure in regards to learning and research experiences.
- **Welcome back pizza lunch**: Students who participated in REUs and off-campus research share their experience and tips for the application process over a pizza lunch on the first day of the fall semester.

**Summer Research Symposium**
- Symposium scheduled on the second Friday of the fall semester
- Formal poster session, similar to those at professional conferences
- Best poster competition judged by alumni, faculty from other institutions, and Widener administrators in related fields
- Keynote speaker
Works Cited

American Academy for the Advancement of Science (2011). Vision and Change in Undergraduate Biology Education. Washington, DC.


