Spring 2018

Advancing Professional Development Strategies for Chemistry and Biochemistry Undergraduates

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ADVANCING PROFESSIONAL DEVELOPMENT STRATEGIES FOR UNDERGRADUATES IN CHEMISTRY AND BIOCHEMISTRY

By

Christian Brown

Submitted in Partial Fulfillment of the Requirements for Graduation with Honors from the South Carolina Honors College

May, 2018

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# Advancing Professional Development Strategies for Undergraduates in Chemistry and Biochemistry

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Thank you to Dr. Amber Fallucca for taking on this project and gracing me with your wealth of knowledge on all things program assessment. You are one of the most encouraging people that I know, and your positive thinking kept me from giving up on multiple occasions.

Thank you to Dr. Thomas Makris for helping me hone my tact as we took a closer look at your CHEM 360 class. You also pushed me to consider my motivations and to appreciate the motivations of others.

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Thank you to Dr. H. Kay Banks for being the best Honors advisor that I could ask for. Your mentorship and friendship has guided me through my Carolina experience and prepared me for life ahead. I love you, and I pray the best for you always.

Thank you to my late mother, Charlie A. Brown Howard, for teaching me to do my best and to never give up. Ever.

[Signature]

Christian A. Brown
Statement of Purpose
The purpose of this senior thesis project was to design and implement advances in current professional development strategies for undergraduates within the Department of Chemistry and Biochemistry through introducing students to on- and off-campus resources that apply to their post-graduation plans. The project evaluates current professional development strategies and offers tested recommendations for continued improvement.

Summary
This project was precipitated by my progression through undergraduate studies at the University of South Carolina between two departments with varying emphasis on professional development (PD) for students. This discrepancy drove me to evaluate current PD strategies and design and test advances for PD strategies for undergraduates in the Department of Chemistry and Biochemistry. These methods were offering a PD planning form to students to help them outline their PD and experiential learning (EL) goals, a 5-session workshop series to directly introduce students to PD topics, and a redesigned version of CHEM 360: Undergraduate Seminar to perpetuate PD training for undergraduates chemistry and biochemistry majors.

Throughout the project, I confirmed that there are many resources available for undergraduate PD on campus, but I realized that our students are not taking advantage of these resources to a widely beneficial level. Possible reasons for this include students’ perceived lack of time for participating in PD activities and a disconnect between how the Department communicates opportunities and how students receive PD information.

Overall, the PD planning form reached 4.3% of students on a voluntary basis and should be included within academic advising appointments in the future. The workshop series reached 2% of students and was considered valuable to attendees in helping them get PD/EL questions answered and learn how to begin acquiring these opportunities. This workshop series should be adapted and repeated for graduate students. The completed course schedule for the new CHEM 360 is located in “Supporting Documents” on page 61. This course should be offered to sophomore and first semester junior students as soon as possible.

My Story and Challenge Statement
As a freshman chemical engineering major, professional development was a required and well-established part of the curriculum. In the introductory class, we were encouraged to take on real application problems and to think like Professional Engineers. Our professor called it “making 101 into 300,” referring to the next course, “Chemical Process Principles,” in which we would be introduced to technical problem solving.  

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1 Hattrick-Simpers, 2016.
In addition to making us think like Professional Engineers, our professor made us work and feel this way by emphasizing professional development. For a grade, we were required to take charge of our education by utilizing university resources. Early in the semester, we drafted resumes and had them reviewed by the Career Center. This was necessary in order to gain full access to JobMate, the University’s career searching Website at the time. We were required to attend multiple professional student organizations in order to introduce us to the engineering community on campus. I became a very active member of the American Institute of Chemical Engineers and the National Society of Black Engineers. Every class meeting, our professor challenged us to stay up-to-date in the field. “What’s new?” he would charge through the door and ask.

When I changed my major to Biochemistry and Molecular Biology, I found that the Department of Chemistry and Biochemistry was different than the School of Engineering and Computing. My new department emphasized classroom learning considerably more than professional development. At first, I thought that this was simply a difference in the direction of each field: basic science versus applied engineering. It was when I applied my professional development knowledge to my basic science that I knew the two could co-exist.

After changing my major, I was determined to try out every application of my science in order to find my fit. Throughout my undergraduate career, I participated in:

- two different academic research experiences;
- a chemical industry internship;
- a federal government science outreach project;
- a foreign hospital pharmacy internship;
- peer leadership as a teaching assistant, tutor, and student organization vice president; and
- a science-based art project.

I wanted to use my four years to explore the possibilities instead of waiting until after graduation to decide on my career and post-graduation plans.

I think that my fellow chemistry and biochemistry undergraduates could benefit from similar high-impact learning experiences facilitated by professional development. Currently, the Department of Chemistry and Biochemistry offers an introduction to chemistry-related fields that is restricted seniors and second-semester juniors. There is also an undergraduate seminar course designed to introduce students to academic research opportunities. This is a good start, but there is always room for improvement.

By broadening the scope of professional development for undergraduate majors with a course for sophomores and first-semester juniors, I believe that students will be encouraged and equipped to pursue as many educational experiences as they can fit in

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2 Kuh, 2008.
four years. Not only can this improve students’ employability, but I expect that it will also streamline their post-graduation trajectory.

**Importance of Professional Development for Chemistry and Biochemistry Undergraduates**

The literature presents a view of professional development (PD) in university science education as a trickle-down economy: improve faculty teaching to improve student achievement. This approach may improve classroom learning outcomes, but what effect does it have on how students pursue experiential learning? Relying on vertically propagated PD perpetuates the socializations of faculty members to the next generation of scientists. In other words, I believe that restricting PD to faculty members perpetuates the apprentice model of academic progression by introducing student dependence on faculty members for directing their education. This limits the development of self-directed learners.

![Flowchart](image)

**Figure 1:** A flowchart illustrating how bottom-up professional development (PD) can influence experiential learning (EL) outcomes in addition to classroom learning (CL) outcomes. Source: the author.

Instead, I believe that a bottom-up approach (providing PD directly to students) is necessary to equip students with ownership of their education while allowing for the evolution of scientific practice. Direct PD for students includes instruction on resume building, networking, and more, while indirect PD for students consists of socializing students into the professional science environment through experiential learning activities, such as internships and undergraduate research.

**Department Undergraduate Curriculum and Career Trajectory**

As of Fall 2016, there were 575 undergraduate majors in chemistry and biochemistry, and the number continues to grow with increased university enrollment and student attraction.

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to the developing discipline of Biochemistry and Molecular Biology. The chemistry program consists of 27 major credit hours with a required minor while the biochemistry program contains 64 major credit hours without a required minor. These credits comprise part of the 128 hours required for graduation, supplemented by Carolina Core, USC’s general education requirements.

Unfortunately, there is little recent departmental data on undergraduate post-graduation activities due to incomplete senior exit interviews of the past few years. The department website states that graduates often pursue careers “at a major pharmaceutical company, in life sciences, at a major research university or a liberal arts college, working for the government, or in an entrepreneurial endeavor of [their] own choosing.” Students frequently attend graduate or medical school. Informal interviews with students confirm these career next steps and reveal students’ uncertainty about how to realize their post-graduation goals.

Professional Society Expectations
The Department of Chemistry and Biochemistry has been approved by the American Chemical Society (ACS) for the department chair to certify undergraduate majors who complete extra requirements for the ACS Bachelor’s degree approval. (The American Society for Biochemistry and Molecular Biology also offers degree accreditation, and the Department submitted an application in March 2018.) ACS approval is conferred to programs that “promote excellence in chemistry education” by endowing students with “the intellectual, experimental, and communication skills necessary to become successful scientific professionals.” This provision is accomplished through approved program infrastructure (facilities and access to information), foundational and in-depth learning in the five traditional sub-disciplines of chemistry (physical, analytical, bio-, organic, and inorganic), undergraduate research, and the development of other student skills in problem-solving, information management, laboratory safety, communication, teamwork, and ethics. The department was approved in the early 1990s and approval is perpetuated through self-evaluation in the form of an in-depth review every five years. It is one of ten approved programs in the state.

In addition to the ACS guidelines, The American Society for Biochemistry and Molecular Biology (ASBMB) has published a checklist for academic and professional development throughout the undergraduate career. This timeline gives an overview of what each student should accomplish in each semester. For freshmen, the document

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5 Department of Chemistry and Biochemistry.
6 “Guidelines for Advisement 2015.”
7 Lovelace, 2017.
8 Department of Chemistry and Biochemistry.
10 Morgan, 2018.
12 “Find an ACS-approved program.”
13 “Undergraduate Training.”
suggests that they network with an advisor knowledgeable in careers and join an ASBMB student chapter. The following year, students should begin searching for research opportunities, internships, and science-related extracurricular activities.

The recommendations for juniors are more detailed. Beyond continuing research or acquiring more internships, the ASBMB suggests that juniors finalize their career plan, consider post-graduate schooling or training, and take electives to “strengthen writing and public speaking skills and learn general business skills.” Seniors are challenged to become functional members of the scientific community by presenting their research at conferences.

**High-Impact Educational Practices Overview**

High-Impact Educational Practices (HIPs) are activities or courses that allow students make connections between what they learned in the classroom and how they want to apply their education post-graduation.15

The HIPs include:

- First-Year Seminars and Experiences
- Common Intellectual Experiences
- Learning Communities
- Writing Intensive Courses
- Collaborative Assignments and Projects
- Undergraduate Research
- Diversity/Global Learning
- ePortfolios
- Service Learning/Community-Based Learning
- Internships
- Capstone Courses and Projects16

Many of these activities are listed as PD involvement options for the PD planning form, which was used to determine Spring 2018 workshop topics (see “Professional Development Involvement” on page 16). Some learning experiences encompass multiple HIPs, and PD is a universal means to prepare students to pursue these HIPs, which will deepen and broaden student learning.

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14 “Undergraduate Training,” p. 2.
15 Kuh, 2008.
16 Kuh, 2013.
Figure 2: A diagram showing how professional development (PD) is central to experiential learning (EL). EL then overlaps with classroom learning (CL) to emerge as integrative learning (IL) when students reflect on their learning. Source: the author.

Experiential learning (EL) takes a hands-on approach to allow students to practice what they learn in the classroom. This includes the teaching laboratory, in addition to several HIPs. PD training prepares students to pursue (EL).

Integrative learning is an intentional practice that encourages students to “ask meaningful questions about complex issues, locate multiple sources of information, compare and contrast information to reveal patterns, and create holistic understanding.”17,18

**Current Professional Development Methods in the Department**

Within the chemistry and biochemistry curricula are two courses that provide direct professional development to Department majors: CHEM 360: Undergraduate Seminar and CHEM 401: Industry Capstone Experience. Undergraduate research for academic credit serves as indirect professional development (CHEM 496-499).

CHEM 360 is designed to introduce biochemistry students to the concept of academic research by allowing faculty members to give 20-minute presentations on their research. CHEM 401 assists undergraduate and graduate chemistry, biochemistry, and biology majors in navigating the “broad spectrum of career opportunities…, which includes manufacturing, sales/marketing, research, and other jobs in industry, medicine, law, government, and academic environments.”19 CHEM 401 is expressly restricted to second-semester juniors and beyond, and it is expected that students will complete CHEM 360 before they become involved in academic research (typically after students take Organic Chemistry, classically a sophomore course). That said, CHEM 360, offered every fall, is expected to be completed by second year students.

**CHEM 360: Undergraduate Seminar**

The purpose of CHEM 360 (one credit hour) is to facilitate interactions between students and faculty members on the topic of academic research, which until the 2015 catalog, was a required three-credit component of the Biochemistry and Molecular Biology

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17 Klein, 2015.
curriculum. Academic research is still required for chemistry majors and for ACS certification of both Chemistry and Biochemistry and Molecular Biology degrees.) With the research requirement eliminated, CHEM 360 now lacks fulfillment in the required curriculum. At the Department curriculum meeting in Fall 2017, the committee decided that CHEM 360 would not be regularly offered, and it is expected that this course officially will become an elective credit in the next catalog. 

Informal interviews with Fall 2017 and former CHEM 360 students revealed that a considerable number of students had been involved in academic research prior to enrolling in the course, and the instructor reported that 20-30% of Fall 2017 students were seniors. This could stem from flexibility in the curriculum to reorder the 67 credits in the 2013 catalog or the 64 credits in the 2015 catalog. When realigning their 4-year outlines, students have been known to place purpose-unknown or purpose-not-required courses toward the end of their undergraduate experience. This trend reveals itself in the high upperclassman enrollment in CHEM 360.

Since the original purpose of CHEM 360 has been removed from the curriculum, it is warranted to redesign the course in order to continue serving students in the Department.

**CHEM 401: Industry Capstone Experience**

The Industry Capstone Experience class is a 3-credit course offered to advanced upperclassmen for the purpose of preparing students "for future roles in chemistry." This course was developed by Dr. Stephen Morgan in conjunction with the formation of the Industrial Advisory Board (IAB) to the Department of Chemistry and Biochemistry in 2002. The IAB requested that the Department instruct students on how to apply for jobs.

Until recently, the course was restricted to seniors and graduate students until some juniors requested special permission to join the course. Now, the course is officially open to second-semester juniors and beyond. The Spring 2018 offering hosted 17 students, 9 of whom entered the University in 2015. No graduate students have enrolled in the past 7 years. The course is now taught by a representative from industry.

In response to a survey provided on April 2, 2018, most students in the Spring 2018 class indicated that they expected to receive information about career options for chemistry/biochemistry majors as well as instruction in skills needed for the workplace. Overall, the average score for meeting expectations was 3.8 on a scale of 1-4.

Industry Capstone Experience represents a capstone course HIP by providing an environment for students to “integrate and apply what they have learned” throughout

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20 Lovelace, 2017.
22 “Guidelines for Advisement 2013.”
23 “Guidelines for Advisement 2015.”
24 “Major Map: Chemistry – Bachelor of Science in Chemistry (B.S.C.),” 2017, p. 2.
their undergraduate studies.25 The course focuses on resume building, presentation skills, and interview skills. According to the syllabus, students complete a personality test, draft cover letters for a hypothetical job application, update their resumes, write about and present on graduate schools and chemical companies, hear from representatives of various industries.

Although the syllabus insists that the course prepares students for many types of career opportunities, the course is largely industry-centric.26 With the large number of students pursuing other career avenues, such as academic research and medical practice, the Department is in need of a more generalized PD course for students.

**CHEM 496-499: Undergraduate Research**
Undergraduate research is a highly valued portion of undergraduate experiential learning in the Department. Undergraduate research advances the purpose of the teaching laboratory by allowing students to gain confidence and independence in their scientific practice. Students coordinate with faculty members in order to secure a position in the faculty member’s research lab. Undergraduates are paired with graduate students or postdoctoral students to assist in the advanced student’s research activities.

This designation is used to indicate undergraduate research for academic credit.27 CHEM 496 is a 3-credit course that necessitates nine contact hours of laboratory per week. Successive course designations allow students to continue to receive academic credit for multiple semesters of research activities.

In the 2015 catalog, the Department removed the CHEM 496 requirement due to inadequate faculty resources.28 With the ever-increasing number of biochemistry students, demand has outstripped the supply of five biochemistry faculty members and the cross-listed BIOL 399: Independent Research, which biochemistry majors could also use to fulfill the research requirement. Even so, it is expected that interested students will continue to pursue undergraduate research regardless of the requirement.29 At least 50% of biochemistry majors enroll in CHEM 496, and it is expected that other students do not use research for course credit.

In order to convey the importance of experiential learning, I suggest that the Department construct a more general requirement for experiential learning that recognizes internships and service learning as satisfactory should students choose not to complete undergraduate research.

27 Lovelace, 2018.
28 Lovelace, 2017.
29 Makris, 2017.
The Need for Professional Development Advancements

Throughout almost 30 years of ACS approval, the Department of Chemistry and Biochemistry has been called upon to produce professional scientists.\(^{30}\) This calling goes beyond education and reaches into training. When the IAB was established in 2002, the Department polled members on how to best prepare students. The IAB replied that scientific facts can be taught on the job and stated that the Department should ensure that students leave the University knowing how to write, communicate, and be a member of the workplace.\(^{31}\) In other words, the companies can educate scientists; the Department should produce professionals.

That said, attention to professional development is necessary in addition to the existing focus on classroom learning. Other university colleges and departments are already appreciating this necessity by hosting rigorous professional development courses in their central and elective curricula. Some of these entities at USC are the College of Engineering, the Career Center, and the Leadership and Service Center, among others. The College of Engineering, like the Moore School of Business, hosts a satellite Career Center office and coordinates an intensive internship program.\(^{32}\) The Career Center offers various World of Work (UNIV 201) courses that introduce students to the workplace and partners with the College of Engineering to produce a PD course specifically for their students.\(^{33}\) The Leadership and Service Center conducts PD cohorts for student organization leaders, among other student groups, and provides resources to facilitate professionalism in leadership training.\(^{34}\)

CHME 360 and CHEM 401, described above are, in effect, providing this training to upperclassmen, in general, and particularly those who already recognize the need for professional development by voluntarily enrolling in CHEM 401. More can be done for sophomores and first-semester juniors, as this student group has more time to accumulate educational experiences or alter their career trajectory. Freshmen are excluded from this group as they are just beginning their university experience and should focus on evaluating themselves in this new environment.\(^{35}\)

Second-year students are nationally recognized as being in a transition state distinct from that of freshmen. Not only are these students often in the process of moving off-campus and becoming more self-sufficient, but also these students are settling into their major course of study beyond general education requirements.\(^{36}\) While these personal and academic transitions seem discrete, professional development can serve as a link between the two by connecting students’ interests with what they are learning in the classroom.

\(^{31}\) Morgan, 2018.
\(^{32}\) Weidner, 2017.
\(^{33}\) Mosich, 2017.
\(^{34}\) Suarez, 2017.
\(^{35}\) Rombach, 2017.
\(^{36}\) Dressler, 2017.
PD training contributes to students’ pursuit of HIPs, which exhibit positive feedback on integrative learning practices.\(^{37}\)

First-semester juniors are especially in a position to make concrete decisions about their post-graduation plans: they have completed enough coursework to be competitive for internship positions, and many companies hire for summer beginning in the fall semester. Access to professional development training before and during this time is invaluable to the application process. More can also be done to help students unaware of these benefits realize the value of obtaining PD during their undergraduate years.

Elective courses are suitable for students who recognize the value of PD and can commit one or three credits during the semester, but other measures are required to reach the remaining student population. Seminars and workshop series reduce the time and credit commitment and allow students the flexibility to attend whichever sessions interest them most. With proper advertising and departmental support, a professional development series combined with robust, curriculum-driven professional development for undergraduates can fulfill the charge of preparing future science professionals. Development and testing of a few PD methods follow.

**Methods and Results**

This project was granted exemption from the Institutional Review Board on November 8, 2017 since this project does not consist of “human subjects research” according to the federal definition. This exemption was confirmed in writing in November 2017. Ethics training was completed through the Collaborative Institutional Training Initiative (CITI) program in accordance with Magellan Scholar grant guidelines.

**Professional Development Plan**

In order to gauge chemistry and biochemistry majors’ involvement in professional development (PD) activities prior to study interventions, a voluntary survey was sent via the Department’s undergraduate Listserv. Form responses were accepted from November 28, 2017 until December 8, 2017. Throughout this 11-day period, 27 responses were collected from the approximately 630 students subscribed to the Listserv (4.3% response rate). The data were used to establish the basal level of student PD activity and to determine which PD topics to include in the Spring 2018 PD workshop series.

**Survey Design**

The PD planning form surveyed chemistry and biochemistry undergraduate majors about their academic demographics; intended career track (See Table I); current, past, and future involvement in PD activities; and preferred topics for a PD workshop series. An annotated sample of the planning form is located in “Supplemental Documents.”

It was necessary to group students based on entry year and other classifications in order to analyze their PD involvement. Upperclassmen are expected to be more engaged in

current and past PD activities than underclassmen. Honors College students and Capstone Scholars are expected to be more involved in PD activities than regular admission students of the same entry year since these students are more likely to pursue additional opportunities.

Respondents’ intended career track may correlate to selected PD involvement. Although biochemistry majors are not required to declare a minor, chemistry major respondents are expected to have entered a minor. The minor may reveal other connections between intended career track and PD involvement.

For the questions on PD involvement, the survey provides a wide variety of options from which respondents could “check all that apply” and/or fill an “other” checkbox with their answer. The options listed many high-impact educational practices, including undergraduate research, study abroad, and internships. Involvement was separated into current, past, and future activities. Only future activity was required for completion of the survey so as not to restrict students who have yet to engage in PD. This section is referred to as “PD involvement” because the section references methods that students have engaged with PD at varying levels of depth. “Involvement” broadly encompasses multiple levels of depth in how students engaged in their PD activities.

Current PD activities consisted of items from the 2017-2018 academic year, including Summer 2018, and should reveal the pre-existing level of PD involvement among department undergraduate majors. Past PD is limited to activities from students’ undergraduate career except for students entering college in 2017 (8/27 respondents). Freshmen were permitted to submit past PD engagement from their high school experience. PD activities that are not on-going experiences are considered under the Past PD question. Future PD plans were limited to taking place within two years in order to gather data on respondents’ reasonably concrete advanced undergraduate or post-graduation plans.

Respondents were required to select three topics from the preliminary list of workshop topics according to what they felt most beneficial to undergraduate PD (see Table II). There was also an option to enter a different topic. These responses were used to coordinate the Spring 2018 workshop series.

Survey responses are subject to voluntary response bias and convenience bias. The source of voluntary response bias comes from the optional nature of the survey since Listserv members were not required to complete the Professional Development Planning (PDP) form. Convenience bias enters consideration because I briefly mentioned the form at an American Society for Biochemistry and Molecular Biology student chapter meeting shortly after releasing the form. This may have persuaded attendees to complete the form, thus swaying the current PD involvement response.

Survey Responses
The PDP survey was compiled and delivered using Google Forms, and the data were analyzed with Microsoft Excel 2011 for the Apple MacBook. Although no respondents
submitted multiple surveys (verified by email address entered by respondents), there was no formal restriction on multiple completions.

**Demographics and Intended Career Track**

There were 27 respondents, 8 of which entered in 2017 (freshmen/1st year), 5 in 2016 (sophomores/2nd year), 9 in 2015 (juniors/3rd year), and 4 in 2014 (seniors/4th year). One student entered in 2013 or earlier, and his or her responses are considered with the seniors. Approximately half (51.9%) of respondents belong to the target audience of sophomores and juniors and all are majors in the department: 70.4% (19/27) Biochemistry and Molecular Biology majors and 29.6% (8/27) Chemistry majors. Twelve students reported declaring a minor and 17 reported belonging to the Honors College (14) or Capstone Scholars (3) groups.

After collecting demographics, the survey polled respondents about their intended career track. The options for this required question are listed in Table I. There was an “Other” option, where participants were invited to enter their own choices. Respondents were asked to check all applicable options. Whereas “Science Education/Outreach” was intentionally left non-specific, “Professional Practice” should have been clarified to indicate medical, pharmacy, dental, or law practice in alignment with various pre-professional tracks offered at USC as two respondents entered “Medicine” in the “Other” category (one also selected “Professional Practice”). These responses were corrected to indicate “Professional Practice.” Interestingly, one respondent (2016, Chemistry/Russian) selected all available career tracks. The only other entry in the “Other” category was “Writing and/or policy;” this respondent also selected “Government Work,” but did not select “Science Education/Outreach,” which is designed to capture science communication and volunteer work. The response was corrected to indicate “Government Work” and “Science Education/Outreach.”

**Table I: Results from PDP intended career track select-all-that-apply question from 27 respondents (forced response).**

<table>
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<th>Intended Career Track</th>
<th>Raw Response (#) n=27</th>
<th>Percentage (%)</th>
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<td>Professional Practice</td>
<td>24</td>
<td>88.9</td>
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<tr>
<td>Industry</td>
<td>8</td>
<td>29.6</td>
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<tr>
<td>Government Work</td>
<td>5</td>
<td>18.5</td>
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<tr>
<td>Academia</td>
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<td>14.8</td>
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<tr>
<td>Science Education/Outreach</td>
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<td>14.8</td>
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**Professional Development Involvement**

The select-all-that-apply options for current, past, and present PD activities were as follows, directly from the survey:

- Internship
- Fellowship
- Academic Research
- Graduation with Leadership Distinction
- ACS Accreditation
• Study Abroad
• Service Learning/Community Service
• Student Organization Membership
• Peer Leadership (ex. Student Success Center employment, U101 peer TA, laboratory TA...)
• Grant Application
• Job Application (if related to your intended career track)
• Professional School Application
• Graduate School Application
• Other

When discussing current PD involvement, twenty-four out of twenty-seven respondents selected applicable choices (88.9% response rate) with no “Other” participation. The most frequent PD involvement was 75% (18/24) participation in “Student Organization Membership,” which should have been restricted to “if related to intended career track.” The next highest involvement was shown in “Service Learning/Community Service” (also should have been restricted to “if related to intended career track”) and “Academic Research” at 41.7% (10/24) and 37.5% (9/24), respectively.

These three activities remained the most frequent when considering past PD involvement (n=22, 81.4%): “Service Learning/Community Service” at 68.2% (15/22), “Student Organization Membership” at 63.6% (14/22), and “Academic Research at 59.1% (13/22).

Forced response to future PD involvement shows top participation in “Internship” and “Academic Research” tied for most frequent at 70.4% (19/27), “Service Learning/Community Service” at 59.3% (16/27), and “Graduation with Leadership Distinction” at 40.7% (11/27).
Figure 3: Current, Past, and Future PD involvement in fractional response rate. Activities are listed in order of decreasing future involvement.

Some corrections were made to the PD involvement responses based on applicability/feasibility of activity to entry year. Four out of six respondents that selected “Graduation with Leadership Distinction” (GLD) under current PD involvement warranted verification since they belonged to entry years 2016 and 2017. It was determined based on their other current PD activities that they could reasonably be making progress toward GLD. Future PD involvement was not considered in this determination since current PD was enough to make a decision, although future PD involvement alone would not warrant current pursuit of GLD, only future pursuit.

The two respondents that indicated “ACS Accreditation” as a current PD activity also entered in 2016 and 2017. Given the advanced nature of the ACS accreditation coursework, these submissions were reviewed for feasibility. The 2017 entry was rejected for lack of current participation in academic research (however the participant did submit another current PD activity, so the number of respondents to current involvement remains the same), while the 2016 entry was accepted based on the presence of past academic research in the college years.

One student entering in 2014 submitted “attending medical school” as a future PD activity. This was rejected as a PD activity due to the nature of continuing academic instruction, albeit for a type of professional practice, that does not constitute developing general professionalism. The respondent’s action of applying to medical school, however, was recorded in his or her selection of past PD involvement in “Professional School Application.” This activity does constitute PD as the application process facilitates reflection and intensive writing.
**Workshop Topics**
The survey suggested seven topics for workshop sessions. Three respondents out of twenty-seven selected more than three options, and two selected fewer than the three indications requested.

**Table II: Forced responses from 27 survey participants indicating their top three choices for professional development workshop topics.**

<table>
<thead>
<tr>
<th>Proposed Workshop Topics</th>
<th>Raw Response (#)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interview and networking skills</td>
<td>21</td>
<td>77.7</td>
</tr>
<tr>
<td>Hearing from professionals in various fields</td>
<td>16</td>
<td>59.2</td>
</tr>
<tr>
<td>Writing applications and personal statements</td>
<td>11</td>
<td>40.7</td>
</tr>
<tr>
<td>Connecting extracurricular activities and academic learning</td>
<td>10</td>
<td>37.0</td>
</tr>
<tr>
<td>Resume/CV writing</td>
<td>10</td>
<td>37.0</td>
</tr>
<tr>
<td>Scientific communication to lay and peer audiences</td>
<td>8</td>
<td>29.6</td>
</tr>
<tr>
<td>Research and professional practice ethics</td>
<td>8</td>
<td>29.6</td>
</tr>
</tbody>
</table>

**Survey Conclusions**
After transforming the data to more uniformly reflect the basal level of PD involvement among undergraduate chemistry and biochemistry majors, the data were evaluated for undergraduate PD indications. The data were evaluated to reflect the PD involvement of the target audience of sophomores and juniors, by enrollment in the Honors or Capstone programs, and by major/minor study.

**By Sophomores and Juniors**
Table III: Comparison of responses between all survey participants and those entering in 2015 or 2016. These years account for 51.9% of survey responses. Significant difference between the groups was not considered due to low survey response rate from Listserv (4.3%)

<table>
<thead>
<tr>
<th>Response Rate Differences between All and 2015/2016</th>
<th>Item</th>
<th>All (%) n=27</th>
<th>2015/2016 (%) n=14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honors College</td>
<td>51.9</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>Capstone</td>
<td>11.1</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Current PD</td>
<td>88.9</td>
<td>85.7</td>
<td></td>
</tr>
<tr>
<td>Past PD</td>
<td>81.5</td>
<td>78.6</td>
<td></td>
</tr>
</tbody>
</table>

Two out of three current PD non-respondents entered in 2016 (2/5 sophomores), which suggests a decline in PD involvement among a critical group. The other current PD non-respondent entered in 2017 (1/8 freshmen). Only one out of nine juniors did not indicate past PD involvement.
Although some students may be discussing PD with their major advisors, there is no formal system for these conversations to take place in advising appointments. Therefore, when comparing sophomore and junior PD to the ASBMB “Undergraduate Training” timeline, suggested discussions with advisors about career plans are considered not to be completed (see “Recommendations,” p.38).

Of the three sophomores reporting both current and past PD, all have participated in or are currently participating in internships or research. This data suggests that some sophomores are pursuing experiential learning but does not reveal if the students are involved in these PD activities as a result of departmental instigation or independent interest. All juniors indicate future plans to apply to professional or graduate school except the respondent minoring in Criminal Justice who solely selected “Government Work” as an intended career path (it is reasonable to determine that advanced education may not be required).

Chemistry Department students appear to be in alignment with the ASBMB timeline (not considering any other extracurricular activities or cross-disciplinary electives suggested by the ASBMB timeline). This PD preparation, however, disagrees with the informal

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\(^{38}\) “Undergraduate Training.”
interviews of students who stated that they feel unsure about making career decisions. It is possible that an adequate PD framework is in place for undergraduates or that these students are employing available resources from elsewhere. In either case, there is room for improvement in integrative learning techniques that will help students make connections between what they are learning in PD training and how to use PD training for themselves. There is also room for improvement in how the Department advertises these opportunities for students.

**By Honors or Capstone Classification**
It appears that Honors College students are more involved in PD activities compared to Capstone Scholars and regular admission students. This may be due to difference in students’ motivation factors or in access to or training with PD resources.

Table IV: Comparison of PD involvement for regular admission students versus Honors College students and Capstone Scholars. Non-respondents were not counted in the average.

<table>
<thead>
<tr>
<th>PD Time</th>
<th>Regular Admit</th>
<th>Honors</th>
<th>Capstone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>2.25</td>
<td>3.46</td>
<td>2.33</td>
</tr>
<tr>
<td>Past</td>
<td>2.5</td>
<td>3.46</td>
<td>2.0</td>
</tr>
<tr>
<td>Future</td>
<td>3.9</td>
<td>4.64</td>
<td>3.5 (outlier 10)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PD Time</th>
<th>Regular Admit (n=10)</th>
<th>Honors (n=14)</th>
<th>Capstone (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Past</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**By Major and/or Minor**
There did not appear to be a difference between careers intended by Chemistry majors and Biochemistry and Molecular Biology majors as all but three respondents selected “Professional Practice.” Of the respondents who did not select “Professional Practice”, one was in Chemistry and the other two in Biochemistry and Molecular Biology.

Out of five students selecting “Government Work,” four declared minors that could be directly related to the field: Criminal Justice, Economics, Environmental Studies, and Russian. The other respondent (BMB) who selected “Government Work” did not report a minor study.

Overall, responses for the career options suggested agree with the post-graduation tracks presented on the Department’s Website (chem.sc.edu).

**Undergraduate Workshop Series on Professional Development**
Using the top results from the PDP question on series topics, an undergraduate workshop series on PD was planned for Spring 2018. The topics are discussed below in the “Schedule” section. Attendance incentives such as prizes and free cookies were provided by company members of the Industrial Advisory Board to the Department of Chemistry and Biochemistry and by Insomnia Cookies in Columbia, SC, respectively.
Learning Outcomes
Upon completion of the workshop series, attentive students should be able to:

1. Identify and complete next steps in their individual professional development plans;
2. List relevant services provided by each presenting office;
3. Differentiate between professional development and classroom learning; and
4. Market themselves effectively to employers and admission committees.

Schedule
The following workshop sessions were planned for the Spring 2018 series. Most presenters were selected from on-campus offices so that students would be able to utilize resources from their offices.

The top five suggested topics from all PDP respondents were incorporated into a list of Spring 2018 presentations. In considering the order of presentations, it was decided that the series should begin with teaching students how to make connections between what they are learning in academic studies with what they can do in a career and PD. This introduction aligns with USC’s integrative learning initiative. This initiative focuses on students “learning from the experience connecting learning to academic study.” After making connections, students “[apply] learning to solve problems and make decisions.”

The next subject, resume building, is considered a basic component in marketing oneself on paper. Interviewing and networking skills allow students to market themselves in person. Writing applications and personal statements is directly aligned achieving post-graduation goals in the form of acceptance to programs for furthering education. It is also a topic that elicits hesitation from undergraduates, so it is important to discuss this topic in the workshop series. Finally, the resource fair introduces students to different career paths through interacting with professionals currently or previously in the field.

Each workshop presentation, except the resource fair, will be followed by a hands-on activity to solidify what was discussed and show attendees how to implement what they learned.

Table V: Schedule of Spring 2018 undergraduate PD workshops taken from PDP.

<table>
<thead>
<tr>
<th>Date</th>
<th>Workshop</th>
<th>Activity</th>
<th>Presenter</th>
<th>Office</th>
<th>Attend.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Feb 86-7pm</td>
<td>Connecting Within-and Beyond-the-Classroom</td>
<td>Key Insights Activity: Matching(^{40})</td>
<td>Dr. Amber Fallucca, Courtney Heier, Timothy Lewis</td>
<td>USC Connect</td>
<td>1</td>
</tr>
<tr>
<td>T Feb 206-7pm</td>
<td>Resume/CV Writing</td>
<td>Tailoring Your Resume</td>
<td>Holly Johnson</td>
<td>Career Center</td>
<td>6</td>
</tr>
</tbody>
</table>

\(^{39}\) “Integrative Learning.”
\(^{40}\) “Appendix A: Key Insights Activity.”
<table>
<thead>
<tr>
<th>Date</th>
<th>Workshop</th>
<th>Activity</th>
<th>Presenter</th>
<th>Office</th>
<th>Attend.</th>
</tr>
</thead>
<tbody>
<tr>
<td>W Feb 28 5:45-6:45pm</td>
<td>Interview and Networking Skills</td>
<td>Drafting an Elevator Pitch</td>
<td>Dr. Teresa Evans</td>
<td>U Texas Heath, San Antonio</td>
<td>1</td>
</tr>
<tr>
<td>T Mar 20 6-7pm</td>
<td>Writing Applications and Personal Statements</td>
<td>none</td>
<td>Jen Bess and Mark Brown</td>
<td>Fellowship and Scholar Programs and Pre-Professional Advising</td>
<td>1</td>
</tr>
<tr>
<td>R Apr 5 10:30am-12noon</td>
<td>Resource Fair</td>
<td>Pharmacy - Kristi Niro</td>
<td>Education - Kathy Henson Biochemistry Club- Nic Elrod and Joelle Strom</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

**Workshop Survey Responses**

Post-workshop surveys were distributed on paper at the completion of each session. (Copies of each survey are available in “Supporting Documents,” p. 43.) Questions were designed to assess student engagement in the presentation and the applicability of the subject matter to each student. Likert-type response anchors were used for graded response questions.\(^{41}\)

Resource fair surveys were delivered via GoogleForms. This survey was not restricted to single completion in order to promote completion by removing the barrier of signing into a Google account as a requirement for single completion.

**Demographic Data**

Table VI: Responses to demographic questions on post-workshop surveys.

\(^{a}\)One participant entering in 2015 self-identified as a senior, and as such, is not counted as part of the target audience.

\(^{b}\)This participant entering in 2013 or earlier self-identified as a junior, and as such, is counted as part of the target audience.

**Workshop Demographical Data**

<table>
<thead>
<tr>
<th>Workshops 1-4</th>
<th>Major</th>
<th>Entry Year</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 Chemistry majors</td>
<td>3 2014</td>
<td>Since 2/10 attendees belonged to target audience of sophomores and juniors, there may be more effective methods of reaching second- and third-year students with direct professional development training.</td>
</tr>
<tr>
<td></td>
<td>6 Biochemistry majors</td>
<td>2 2015(^{a})</td>
<td>1 2016</td>
</tr>
<tr>
<td>Workshop 5</td>
<td>Major</td>
<td>2 Chemistry majors</td>
<td>2 Biochemistry majors</td>
</tr>
<tr>
<td>Entry Year</td>
<td>1 2013 or earlier(^{b})</td>
<td>1 2016</td>
<td>2 2017</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Although 2/4 participants belonged to the target audience, overall participation was low indicating that there may be a better day or time for a resource fair-type of intervention.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{41}\) Vagias, 2006.
Although respondents of the Professional Development Planning form requested early evening for the workshop series, a survey delivered to the CHEM 401 class (juniors and seniors) on April 2, 2018 suggested that this time-of-day was a potential barrier to participation in professional development activities. Additionally, many classes were conducting exams during the weeks of the first and third workshops, specifically, and possibly during other workshop weeks.

**Numerical Data**

Table VII: Numerical responses from post-workshop surveys. Data includes W1-4 unless indicated.

*a* This scale was transformed post-completion in order to include only positive numbers.

*b* Data includes responses from W5. Total n=14.

*c* This average response is likely subject to bias of convenience due to sampling a specifically invested party.

<table>
<thead>
<tr>
<th>Base Question</th>
<th>Variable Question</th>
<th>Scale</th>
<th>Average (n=10)</th>
<th>Conclusion: Workshop participants generally agreed that…</th>
</tr>
</thead>
</table>
| Expectations  | Workshop          | 1- Not met  
2- Somewhat  
3- Mostly  
4- Met | 3.8 | Expectations for each workshop were mostly met to met. |
| Relevancy     | Presentation      | 1- Not Relevant  
2- Somewhat  
3- Mostly  
4- Very | 3.8 | Each presentation and activity was mostly to very relevant to participants. |
|               | Activity          |       | 3.8           |                                                         |
| Preparedness  | Pursue professional development | 1- A lot less  
2- Less  
3- About the same  
4- More  
5- A lot more* | 4.3* | Participants felt more to a lot more prepared to pursue professional development opportunities. |
| Importance    | Experiential Learning | 1- Not a priority  
2- Low  
3- Medium  
4- High | 3.6* | Experiential learning is a medium to high priority. |
| Support       | Departmental undergraduate experiential learning | 1- Very poorly  
2- Poorly  
3- Well  
4- Very well | 2.8* | The Department supports undergraduate experiential learning poorly to well. |

For most of the survey questions, a neutral answer was not included in the Likert-type scale in order to force participants to commit to a response. For “Preparedness” however, an option for no change was offered in order to respect that participants may not learn anything new or feel more or less prepared by the workshop session. Similarly, participants were permitted to select “Not a priority” for how important they feel that experiential learning is to them.
Qualitative Data

When discussing their expectations for the workshops, participants generally agreed that they were able to have their questions about professional development answered “efficiently and concisely” (Participant W1-1). In reference to their main takeaways from the presentations or activities, four out of ten participants for Workshops 1-4 explained that they knew where to start searching for experiential learning (EL) opportunities or resources. Two others from Workshops 1-4 stated that they felt better or more confident about pursuing these opportunities. These responses indicate that students have achieved Learning Outcome 1 in articulating the next steps in their PD plans.

In reference to the importance of EL, four out of fourteen Workshops 1-5 participants acknowledged that “applying skills learned in the classroom is important” (Participant W2-3), as well as gaining more experience in a certain field (Learning Outcome 4). Other responses more generally highlighted the importance of EL. However, the applicability of these responses to how the major population perceives EL is weak due to potential sampling bias. Students who voluntarily participated in the workshop series likely value EL more than other students who did not participate.

In reference to Learning Outcome 2, students attending Workshops 1 or 2 were asked to list which resources from the presenting offices that they would use. Six out of seven indicated that they would utilize the USC Connect online database or the Career Center drop-in resume review service.

These qualitative responses mirror the high numerical responses for the questions about how students perceived the workshops, felt more prepared to pursue PD, and rated their importance of EL.

There was mixed opinion among the participants about how the Department is supporting undergraduate PD (Learning Outcome 3). It was important to ask this question in order to determine if the study interventions were warranted for improving PD because if students already thought that the Department was serving undergraduate PD very well, then there would be no need for the study interventions.

Four out of fourteen Workshops 1-5 participants specifically referenced the undergraduate Listserv emails as a resource for PD. Half of these responses were positive and appreciated the emails, while the other half chided the Department for seemingly not extending PD resources beyond the emails. (There are other PD resources offered by the Department, although most are not undergraduate-specific. The Listserv is the main mode of communication between the Department and students for these opportunities.) One student out of fourteen confused “help with choosing courses” as a PD activity.

Four out of fourteen other responses focused on undergraduate research. One of those response requested research opportunities to be more visible, while another praised Department undergraduate PD specifically because this student was already an undergraduate member of a research lab. Overall, these responses indicate that there is room for other PD methods with the Department of Chemistry and Biochemistry whether
in the communication of opportunities or in the variety of PD and EL opportunities supported.

**Workshop Reflections**
The sections below detail how each workshop progressed.

**Workshop 1: Professional Development for Chemistry and Biochemistry Undergraduates**
The first workshop in the series was held on Thursday, February 8th, 2018 at 6pm in Jones 203. The office of USC Connect delivered a PowerPoint presentation on the importance and value of professional development (PD) and how PD fits into experiential learning (EL) and integrative learning. After the presentation, the facilitators gave an overview of the online database that USC Connect maintains for a variety of learning experiences organized by major or by type of involvement. Following the lecture portion of the workshop, the attendee was given the time to complete the “Key Insights Activity: Matching.” This activity allows students to make connections between their within-the-classroom concepts and beyond-the-classroom experiences.

Attendance was one person (potentially due to a test-heavy week). The survey was collected on paper, and the answers were entered in MS Excel for future analysis.

Due to level of attendance, the presenters were able to tailor the discussion to the attendee's interests and specific questions. At the end of the workshop, the attendee stated that she felt more equipped to pursue EL. She asked questions about getting engaged in EL and about the expectations of pursuing certain experiences.

**Workshop 2: Resume/CV Writing for Chemistry and Biochemistry Undergraduates**
The second workshop was held on Tuesday, February 20th, 2018 at 6pm in Jones 201. The Career Center facilitated a discussion resume writing and the difference between resumes and CVs. The projector lamp was out in this room, so after a brief introduction of the topic and the audience demographic, participants were divided into two groups: those looking to improve resumes and those looking to begin a resume. There were 3 freshmen attendees and 3 seniors that divided with 5 in the "improving resume" group and 1, a senior, in the "beginning resume" group.

For about 15 minutes in the "improving resume" group, the Arts and Sciences Career Development Coach, and 2 peer coaches led a workshop on strengthening bullet points and targeting a resume for a particular audience. This included prioritizing experiences and using language from job descriptions in bullet points. During this time, a peer coach worked with the senior who was beginning a resume.

After the breakout session, the groups came back together to discuss where to list certain items on the resume and the separation between relevant experience and additional experience. During this portion, the members of the audience were able to get specific questions answered about their resume and types of experiences to be pursuing. Toward the end of the session, the audience began to get restless, but throughout, the main
facilitator mentioned that they were unusually engaged, potentially due to the lack of PowerPoint presentation in favor of a more personal presentation style.

**Workshop 3: Interviewing and Networking Skills for Chemistry and Biochemistry Undergraduates**
The third PD workshop was hosted on Wednesday, February 28th, 2018 at 5:45pm in Jones 203. Teresa Evans, PhD, was invited to present a combination of her two presentations delivered at the Preparing Science Professionals workshop coordinated by the University of Kentucky in partnership with the American Society for Biochemistry and Molecular Biology. The presentation was delivered virtually using Google Hangouts.

One sophomore attended the workshop on networking and used this personalized attention to ask many questions about how to apply networking skills appropriately and efficiently. Two handouts were provided at the workshop: a copy of Dr. Evans' slides and a quarter-sheet adaptation of the "Art of Mastering Small Talk for Scientists," 10 steps for effective networking. I noticed the differences between giving similar presentations to a large group versus a small, or even singular, group. The smaller environment could be tailored to individual needs in exchange for a less formal atmosphere.

A technology test of the equipment was conducted on February 22nd during which we decided to use two devices to facilitate the workshop. The main desktop computer in Jones 203 would project Dr. Evans' and her slides to the room, while a laptop on the front table would provide a camera for Dr. Evans to be able to hear and see participants. We tested using a third device on the call to serve as a microphone for participants, but feedback ensued, and the idea was discontinued.

On the day of the presentation, there was limited time to set up the devices. In this time, I discovered that the Ethernet cable had been disconnected from the main desktop and that there was new echoing between the desktop and laptop that was not present during the technology test. Due to the size of the audience, this was not a limiting factor, and the entire workshop presentation was conducted using the laptop at close range to the participant. During the presentation, the laptop speaker malfunctioned resulting in intermittent silence. This problem was solved by entering the call on a third device, an iPad, and disabling the microphone and speaker on the laptop.

Overall, virtual presentation is an effective way to present long-distance expertise at low cost. Be sure to schedule enough time to re-test technology on the day of the presentation.

**Workshop 4: Writing Personal Statements for Chemistry and Biochemistry Majors**
The fourth workshop was hosted on Tuesday, March 20th, 2018 at 6pm in Jones 201. The session featured Jennifer Bess, director of national fellowships in the Office of Fellowship and Scholar Programs (OFSP), and Mark Brown, associate director of the

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42 Greer and Evans, 2017.
43 Evans and Freeze, 2017.
The content consisted of a pre-recorded Pecha Kucha-style video from OFSP on targeting the audience from in a personal statement supplemented by additional advice from OPPA. Originally, the plan was for OPPA to facilitate their activity “Your Personal Statement: Grab Their Attention,” but the facilitator declined to complete the activity due to its focus on medical school in the midst of an audience committed to graduate school. One person, a junior, attended this workshop.

The Pecha Kucha video displayed 20 images for 20 seconds each, over which Jen Bess discussed example prompts, potential target audiences, clearly conveying personal characteristics, and producing a holistic essay. The audience was attentive during this 6-minute video and took notes. The student actively participated in the conversation with Mark Brown and asked several questions, including how much research experience to mention in the personal statement and what his favorite characteristics were in a personal statement.

Given the expertise of OPPA, most of Mark Brown’s advice and responses were focused on medical and law school. At the end of the workshop, the attendee suggested that I include Dr. Maksymilian Chruszcz in future discussions because he is one the graduate school committee for Biochemistry and reviews personal statements in applications.

Since the workshop ended early, the attendee and I talked afterwards for about 20 minutes about professional development strategies in the Department, our similar backgrounds in the College of Engineering, and future directions post-graduation for ourselves and for the project. The student mentioned wanting to attend the other workshops (at least the resume workshop) but was unable to due an extracurricular commitment and exams.

In attempt to make this video available to all chemistry and biochemistry majors, I petitioned the Department to create a Blackboard Learn module located in the CHEMUG-BIOCHEMUG organization (the same organization that houses the Department’s undergraduate email listserv). This request was rejected by the department chair, and it was suggested that I coordinate the effort with CHEM 401.

The usefulness of making the video available is that after the workshop was finished, I was able to share the information verbatim with another undergraduate, a senior, and collect another survey. Therefore, the workshop audience had effectively doubled as a result of using a reproducible platform.

**Workshop 5: Resource Fair**

Instead of the original panel discussion proposal, the final workshop consisted of a resource fair conducted on Friday, April 6th, 2018 from 10:30am-12noon in the lobby of Coker Life Sciences. The fair was designed so that students could visit the tables in between classes and receive information about different career paths.

Originally, the career paths to be represented were academia, medicine, government work, chemical industry, pharmacy, and STEM education/outreach. During the fair, table
hosts were present from pharmacy, STEM education, and the biochemistry student organization. This smaller arrangement worked well for the space along the elevator-side of the lobby and presented a manageable task for the time and people involved.

Six students (4 from Chemistry and Biochemistry) visited tables and completed a survey before receiving participation incentives in the form of cookies donated by Insomnia Cookies and marketing materials donated by members of the Department’s Industrial Advisory Board. The conversations between students and table hosts centered on students’ post-graduation plans and professional goals. Additionally, students were surprised to learn about the far-reaching career options for pharmacists- 28 different fields ranging from veterinary to nuclear pharmacy. Also, the representative from the College of Education was able to clarify for one student the difference between pathways to higher education and K-12 education.

Summary and Lessons Learned
The purpose of the workshop series was to offer direct PD instruction to undergraduate chemistry and biochemistry majors during the Spring 2018 semester. The goal was to differentiate between as many effective and ineffective methods as possible for PD communication.

Overall, I found that short, reproducible methods, such as the Pecha Kucha video, were the best ways of engaging students. The resource fair was also effective in quickly providing students with information without requiring them to make plans to attend an hour-long event. Additionally, I found that students responded better to topics that produced concrete, immediate results, such as in the case of a resume workshop.

At the beginning of this project, I discussed potential methods of PD communication with the Department’s Undergraduate Program Coordinator who recommended that my interventions be student led and not rely on too much input from professors or administrators. The coordinator cited that this group was already busily engaged in managing classroom learning among other responsibilities. As a result of this successful workshop series, it is my goal that members of the Department will be more willing to engage in this form of experiential learning for their students now that I have evaluated the efficacy of a few PD methods.

In coordinating this workshop series, I have learned the value of building a dedicated team early on and enlisting the support of members of the Department as soon as, or even before, I have devised all of the concrete details of an event. I have also been exposed to the task of developing meaningful surveys. It took much consideration on my part to devise questions to provide useful feedback and evaluation of my interventions. I also learned to put the most important questions on the first page of the survey, because not everyone remembers to check both sides of their papers. All workshop surveys can be found in “Supporting Documents,” p.43.

44 Lovelace, 2017.
The next stage of the project, redesigning CHEM 360, incorporates workshop-tested PD lessons and more into a transposable segment of the Department of Chemistry and Biochemistry curriculum.

CHEM 360: “Undergraduate Seminar” Course Development

Course Development
The course re-design of CHEM 360 was undertaken with Dr. Thomas Makris, the course instructor for the past 3 fall semesters. In the previous semester, Dr. Makris attempted to introduce a professional development module in the form of crafting scientific PowerPoint presentations, but this module was cancelled for lack of class time.

The course development generally followed the outline in "Developing a Course Syllabus" by Dr. Michelle Hardee of the USC School of the Earth, Ocean, and Environment delivered on November 29th, 2017 at the USC Center for Teaching Excellence. This outline addresses the following steps:

1. Determine audience and course purpose - understand the population of students in a class (e.g. majors versus non-majors), and "establish curricular priorities" using Fink's Taxonomy of Significant Learning
2. "Write specific Student Learning Outcomes" - craft measurable, student-focused learning outcomes that detail what students should be able to accomplish upon successful completion of the course
3. Decide how to assess student learning - use representative and varied assessments that allow students to demonstrate their learning in alignment with Universal Course Design
4. Decide how to grade the assessments - for example, point scale, pass/fail, letter grades, and ensure that each assignment is properly weighted
5. "Determine specific learning activity for each Student Learning Outcome" - outline what students will be doing for each learning outcome
6. "Choose appropriate teaching strategies" - devise teaching strategies to facilitate student learning and accomplish outcomes
7. Sequence the activities - place each module into context with which lessons come before and after
8. Foresee what could go wrong - think about the kinds of situation that could arise and evaluate how activities motivate and encourage students

The majority of the course development was completed in Spring 2018 with steps 1 through 7 performed in the first half of the semester and the remaining steps, along with a syllabus and sample lesson plans, in the second half of the semester.

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45 Hardee, 2017.
46 Dunn, 2017.
Throughout biweekly meetings with Dr. Makris, we agreed that the target audience for the course is sophomore and junior chemistry and biochemistry majors, which aligns with the ASBMB recommended timeline. Advisors should be notified when the new CHEM 360 will be offered and informed of its benefit to students. The modules are listed below in Table VI in the most ideal sequence. The table includes specific student learning outcomes, learning activities, teaching activities, and module assessments.

**Alignment with Learning Models**

**Significant Learning**

It was determined that this PD class involves three branches of Fink’s Significant Learning: human dimension, integration, and learning how to learn. Fink describes the “human dimension” principle as “learning about oneself and/or others.” The new PD course facilitates students’ understanding of the human dimension by allowing student deepen their self-awareness by completing the Workplace Big 5 assessment. This assessment is managed by the Leadership and Service Center. Students are also encouraged to interact with their peers through think-pair-share learning activities and with their superiors through formal and informal interview instruction from the Career Center.

The “integration” principle consists of “connecting ideas, people, and/or realms of life,” which is accomplished through multiple course modules. USC Connect will direct students to make connections between within-the-classroom concepts and beyond-the-classroom experiences. The “Applying Yourself” module encourages students to use and grow their network by reaching out professors for experiential education opportunities and letters of recommendation. The “Explaining Yourself” module teaches students to clarify their ideas so that others can readily understand the scientific material.

In “learning how to learn,” Fink includes “becoming a better student, inquiring about a subject, and/or, self-directed learners.” A purpose of this PD course is to introduce students to resources available on campus. Upon successful completion of the course, students will be able to diagnose where deficiencies lie in their professional development, and they will be able to find information to supplement the deficiency.

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47 “Undergraduate Training.”
Table VIII: Descriptions of each module of the new PD course, including the learning outcomes, how information is presented to students, how students will interact with the information, and how the instructor will facilitate learning.

<table>
<thead>
<tr>
<th>Module Item:</th>
<th>Office/Source:</th>
<th>Students will produce:</th>
<th>How to assess:</th>
<th>Learning activity:</th>
<th>Teaching strategy:</th>
<th>Specific Learning outcome:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td>Expectations of course</td>
<td>Pass/Fail</td>
<td>Individual brainstorming</td>
<td>Lecture on structure</td>
<td>Upon successful completion of this module, students should be able to:</td>
</tr>
<tr>
<td>2</td>
<td>Within- and Beyond-the-Classroom</td>
<td>USC Connect</td>
<td>Connections worksheet</td>
<td>Pass/Fail</td>
<td>Small group discussion</td>
<td>Facilitate group</td>
</tr>
<tr>
<td>3</td>
<td>Workplace Big 5</td>
<td>Leadership and Service Center</td>
<td>Agree/disagree reflection</td>
<td>Pass/Fail</td>
<td>Large group activity</td>
<td>Facilitate group</td>
</tr>
<tr>
<td>4</td>
<td>Research Professions</td>
<td>Career Center</td>
<td>Summary of career choice</td>
<td>Pass/Fail</td>
<td>Listen to lecture</td>
<td>Lecture on resources</td>
</tr>
<tr>
<td>5</td>
<td>Resume</td>
<td>Career Center</td>
<td>Resume check with CC</td>
<td>Pass/Fail</td>
<td>Listen to lecture</td>
<td>Lecture on structure</td>
</tr>
<tr>
<td>6</td>
<td>Informal and Formal Interview</td>
<td>Career Center</td>
<td>Reflection on informal interview; behavioral interview questions</td>
<td>Point System</td>
<td>Pairs role-playing</td>
<td>Facilitate activity</td>
</tr>
<tr>
<td>7</td>
<td>Social Media</td>
<td>Career Center</td>
<td>Complete LinkedIn profile</td>
<td>Point System</td>
<td>Individual brainstorming</td>
<td>Lecture on subject</td>
</tr>
<tr>
<td>Module Item</td>
<td>Office/Source</td>
<td>Students will produce</td>
<td>How to assess</td>
<td>Learning activity</td>
<td>Teaching strategy</td>
<td>Specific Learning outcome</td>
</tr>
<tr>
<td>---------------------------------</td>
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<td>---------------------------------------</td>
<td>---------------</td>
<td>----------------------</td>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Applying Yourself</td>
<td></td>
<td>Confirmation of application</td>
<td>Pass/Fail</td>
<td></td>
<td></td>
<td>Develop concrete and attainable next steps in their college or post-graduate plans</td>
</tr>
<tr>
<td>8 Discovering Opportunities</td>
<td>OFSP/CC/OUR/ USC Connect</td>
<td>Summary of # opportunities</td>
<td>Pass/Fail</td>
<td>Listen to lecture</td>
<td>Lecture on resources</td>
<td></td>
</tr>
<tr>
<td>9 Obtaining Opportunities</td>
<td>Office of Undergraduate Research</td>
<td>BCC of email sent</td>
<td>Point System</td>
<td>Think-Pair-Share</td>
<td>Facilitate activity</td>
<td>Professionally request experiential learning positions</td>
</tr>
<tr>
<td>10 Letters of Recommendation</td>
<td>Office of Undergraduate Research</td>
<td>BCC of email sent</td>
<td>Point System</td>
<td>Listen to lecture</td>
<td>Lecture on structure</td>
<td>Professionally request references for experiential learning opportunities</td>
</tr>
<tr>
<td>Explaining Yourself</td>
<td></td>
<td>Journal club presentation</td>
<td>Point System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Non-Scientist Interactions</td>
<td>ASBMB/ACS/ TEDTalk</td>
<td>8th grade level paragraph</td>
<td>Point System</td>
<td>Pairs role play</td>
<td>Facilitate activity</td>
<td>Communicate science clearly and concisely to diverse audiences in verbal encounters</td>
</tr>
<tr>
<td>12 Elevator Pitch</td>
<td>Internal</td>
<td>30 sec elevator pitch</td>
<td>Point System</td>
<td>Think-Pair-Share</td>
<td>Facilitate activity</td>
<td>Communicate science clearly and concisely to diverse audiences in verbal encounters</td>
</tr>
<tr>
<td>13 Making Slides</td>
<td>Internal</td>
<td>Journal club presentation (same as above)</td>
<td>Point System</td>
<td>Small group activity</td>
<td>Facilitate groups</td>
<td>Communicate science clearly and concisely to diverse audiences in presentation format</td>
</tr>
</tbody>
</table>
Integrative Learning
In accordance with USC’s integrative learning (IL) initiative, the new CHEM 360 course assists students in making connections between their classroom and experiential learning by facilitating how students obtain learning experiences beyond-the-classroom.

The new CHEM 360 course serves the need of PD for undergraduates, which feeds into students successfully obtaining experiential learning (EL) opportunities. Students can then relate these EL opportunities to what they learned in the classroom. This course builds the foundation for students to pursue IL.

High-Impact Educational Practices
As previously described, high-impact educational practices (HIPs) promote integrative learning by fueling experiential learning and providing structured environments for reflection. The new CHEM 360 contains and supports the following HIPs:

- Collaborative Assignments and Projects,
- Undergraduate Research, and
- Internships.

Eight out of twelve of the CHEM 360 lessons incorporate Collaborative Assignments and Projects as part of the learning activities. These methods are: small groups, large groups, role-playing, and Think-Pair-Share. By conveying PD training in the form of group assignments, students have the opportunity to build community among each other. This early network provides students with a model to work as a team in future EL and post-graduation endeavors.

The new CHEM 360 also supports Undergraduate Research and Internships by building the foundation of PD for students to successfully acquire these EL opportunities.

Universal Course Design
Information on Universal Course Design was acquired at a Center for Teaching Excellence workshop conducted by Casey Carroll, instructional designer, on “Universal Design for Learning Guidelines,” delivered on October 16th, 2017. This workshop addressed the three main principles of Universal Design:

1. Providing multiple means of engagement in order to motivate learners
2. Providing multiple means of representation for creative learning
3. Providing multiple means of action and expression for proactive learners

The new CHEM 360 relies on multiple means of engagement and action by incorporating a variety of learning activities for students. Beyond listening to lectures, these learning activities include: think-pair-share, role-playing, and small and large group discussion. The goal of these communal learning activities is to foster interaction between students not only to promote analysis and reflection, but also to build a support system among students as they continue their academic progression.

49 Kuh, 2008.
50 Carroll, 2017.
Multiple means of representation are addressed in the deliverables for each lesson. The beginning of the semester focuses on reflection pieces from short answer to short essay, which provide students with different ways of expressing their thoughts. In addition to reflection, students also build or modify a LinkedIn profile, which may resonate more with students who prefer digital outlets. The second half of the semester focuses on communication in different formats: over email, in person, and through presentation. Multiple means of communication equip students to represent their ideas using a variety of media.

**Learning Outcomes**

Each lesson within a module fulfills a specific, measurable student learning outcome. The learning outcomes in Table VIII relate directly to increasing student performance in the workplace, whether that is in academic research, chemical industry, medical practice, public sector, and more.

Learning outcomes fall into the following general categories:

- Making connections
- Understanding the work environment
- Communicating clearly and professionally
- Acquiring experiential learning opportunities

**Making Connections**

This learning outcome is supported by four modules: Within- and Beyond-the-Classroom, Informal and Formal Interview, Obtaining Opportunities, and Non-Scientist Interactions. Collectively, these modules equip students to make connections between their experiential and classroom learning and between themselves and others.

In order to make connections between experiential and classroom learning, the Within-and Beyond-the-Classroom module features instruction from the Office of USC Connect. This branch of the Office of the Provost manages the USC initiative of integrative learning.\(^{51}\) In this module, the facilitator would highlight the differences between classroom learning, which occurs in the form of lecture- or seminar-style course, and experiential learning, which occurs in the field of practice or in socialization with professionals. Students will produce a complete Making Connections worksheet adapted from the Graduation with Leadership Distinction E-Portfolio Content Guide, Appendix A “Key Insights Activity.”\(^{52}\)

While making connections between themselves and others, students will conduct informal interviews with graduate students or professionals in their desired field, digitally network with potential employers, and practice explaining their science to a lay audience. In Informal and Formal Interview, the Career Center will present on how to do and the differences between formal and informal interviews. After the presentation, students will

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\(^{51}\) Fallucca, 2017.

\(^{52}\) GLD E-Portfolio Content Guide 2017-2018.
be given the opportunity to devise questions for their required informal interviews. In
order to facilitate the informal interviews, students will have the opportunity to check out
an Out-to-Lunch ticket from the Student Success Center for the purpose of treating a
University faculty member to lunch.

In Obtaining Opportunities, students will learn how to professionally connect with
sources of experiential learning opportunities. The Office of Undergraduate Research will
direct students on how to construct the first email when reaching out to Primary
Investigators. This model is transferable to other types of experiential education, and
students will discuss their experiential interests with each other. In addition to
communicating with their peers, the Non-Scientists Interactions lesson prepares students
to connect with other audiences by matching their scientific explanations to their
audiences’ level of understanding. Instruction will come from TED Talks, American
Chemical Society resources, and/or American Society for Biochemistry and Molecular
Biology resources. Students will describe their experiential learning activities at the 8th
grade level.

Understanding the Work Environment
This learning outcome focuses on preparing students for their post-graduation plans in a
variety of work environments from academic labs to industry labs to the public sector.
There are two lessons that support this learning outcome: Workplace Big 5 and Research
Professions.

The Workplace Big 5 lesson unpacks students’ scores on the Workplace Big 5
assessment by Paradigm Personality Labs LLC that reveals where students lie along the
spectrum of five major personality traits: Need for stability, Extraversion, Originality,
Accommodation, and Consolidation. Students will also receive the scores for their
twenty-three personality subtraits, but these subtraits will not be discussed in the lesson.
Homework for this lesson consists of a reflection worksheet that students will use to
convey whether they agree or disagree with their scores and why.

The Leadership and Service Center will facilitate this lesson with one of their presenters
certified to deliver the assessment. Students can use the Workplace Big 5 assessment to
help them understand how they perceive and react to general conditions found in the
workplace.

In the Research Professions lesson, students will dive deeper into their intended career
pathways to learn more about the daily tasks of that profession as well as the educational
and experiential requirements to enter that profession. Students will follow up on this
research in the Informal and Formal Interview lesson where students will conduct an
informal interview with a member of their intended career pathway.

Communicating Clearly and Professionally
The last four lessons support this learning outcome: Letters of Recommendation, Non-
Scientists Interactions, Elevator Pitch, and Making Slides. These lessons teach students
how to request or relay information clearly and professionally.
In the Letters of Recommendation lesson, the Office of Undergraduate Research will show students how and when to request recommendations from their professors. The deliverable for this lesson is for students to list two to four options for academic and professional recommenders.

In Non-Scientist Interactions, students will watch various TEDTalks and ACS or ASBMB videos about how to communicate science to the public. This lesson will also cover the importance of science outreach as well as some basic efforts to include the public in scientific discussions.

The Elevator Pitch lesson combines Dr. Teresa Evans’ Workshop 3 presentation with internally supplied information on crafting a functional elevator pitch. This lesson will allow students to concisely relay their immediate objectives and post-graduation goals.

Acquiring Experiential Learning Opportunities
The last learning outcome for the new CHEM 360 supports how students seek out and obtain EL opportunities. This learning outcome is supported by several lessons: Resume Writing, Researching Professions, Informal and Formal Interview, Discovering Opportunities, Obtaining Opportunities, and Letters of Recommendation.

In the Discovering Opportunities lesson, students will make a list of three to four EL opportunities along with their requirements for application, application deadline, and learning goals for the experience.

This learning outcome addresses the nature of the new CHEM 360 course as the PD training foundation for students’ pursuing EL (see Figure 2 on page 10).

**Learning Activities and Grading**
As previously described, eight out of twelve lessons consist of partner or group learning activities, whereas students listen to lectures for the remaining four. In light of workplace collaboration, it is important to include group work in PD training since the majority of traditional classroom learning does not contain group work.

Students’ assignments will be weighted relative to completion time or importance on a point-scale totaling 235 points. The table below breaks down the points attached to each assignment.

**Table IX: Grading scale for the new CHEM 360.**

<table>
<thead>
<tr>
<th>Module Item</th>
<th>Students will produce:</th>
<th>How to assess:</th>
<th>Points Assigned:</th>
<th>Percentage:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>Expectations of course</td>
<td>Pass/Fail</td>
<td>5</td>
<td>2.13%</td>
</tr>
<tr>
<td><strong>Connecting Yourself</strong></td>
<td>Self reflection</td>
<td>Pass/Fail</td>
<td>20</td>
<td>8.51%</td>
</tr>
<tr>
<td>WTC and BTC</td>
<td>Connections worksheet</td>
<td>Pass/Fail</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Workplace Big 5</td>
<td>Agree/disagree reflection</td>
<td>Pass/Fail</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Research Professions</td>
<td>Summary of career choice</td>
<td>Pass/Fail</td>
<td>5</td>
<td>2.13%</td>
</tr>
<tr>
<td><strong>Marketing Yourself</strong></td>
<td>Professional headshot</td>
<td>Pass/Fail</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Module Item</td>
<td>Students will produce:</td>
<td>How to assess:</td>
<td>Points Assigned:</td>
<td>Percentage:</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------------------------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Resume</td>
<td>Resume check with CC</td>
<td>Pass/Fail</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Informal and Formal Interview</td>
<td>Reflection on informal interview; behavioral interview questions</td>
<td>Point System</td>
<td>20</td>
<td>8.51%</td>
</tr>
<tr>
<td>Social Media</td>
<td>Complete LinkedIn profile</td>
<td>Point System</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Applying Yourself</td>
<td>Confirmation of application</td>
<td>Pass/Fail</td>
<td>50</td>
<td>21.28%</td>
</tr>
<tr>
<td>Discover Opportunities</td>
<td>Summary of # opportunities</td>
<td>Pass/Fail</td>
<td>5</td>
<td>2.13%</td>
</tr>
<tr>
<td>Obtaining Opportunities</td>
<td>BCC of email sent</td>
<td>Point System</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Letters of Recommendation</td>
<td>BCC of email sent</td>
<td>Point System</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Explaining Yourself</td>
<td>Journal club presentation</td>
<td>Point System</td>
<td>30</td>
<td>12.77%</td>
</tr>
<tr>
<td>Non-Scientist Interactions</td>
<td>8th grade level paragraph</td>
<td>Point System</td>
<td>10</td>
<td>4.26%</td>
</tr>
<tr>
<td>Elevator Pitch</td>
<td>30 sec elevator pitch</td>
<td>Point System</td>
<td>20</td>
<td>8.51%</td>
</tr>
<tr>
<td>Making Slides</td>
<td>Journal club presentation (same as above)</td>
<td>Point System</td>
<td>0.00%</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td></td>
<td>235</td>
<td></td>
</tr>
</tbody>
</table>

**Course Metrics**

In addition to identifying success metrics for students within the course, it is also necessary to evaluate the effect of direct professional development instruction for sophomores and juniors on the Department.

The first method of this assessment is found in reviewing course evaluations from the students in the course. This data provides subjective insight into how students self-report their outcomes and their perception of the instructor and the instruction provided.

More objective evaluations will occur in two stages: immediately post-course (within the following semester) and collectively as the course continues to be offered. More immediate evaluations consist of how many students obtain summer internships or academic research positions as a result of course assignments. Lessons that directly tie into this metric include:

- Resume Building,
- Informal and Formal Interview Skills,
- The “Marketing Yourself” summary assignment of visiting the Science, Engineering, and Technology career fair,
- Obtaining Opportunities, and
- Letters of Recommendation.

Another objective evaluation is the trend in course enrollment over time (normalized for matriculation). It is known that when students prefer certain professors or find certain
New CHEM 360 Differs from Current CHEM 401 and UNIV 101

Different from CHEM 401
Currently, the Department offers the PD course CHEM 401: Industry Capstone Experience to seniors and second-semester juniors. As previously described, this course mainly introduces students to working in the chemical industry and also includes a couple general PD topics, such as resume and cover letter writing. Although the new CHEM 360 also includes resume writing, the sole purpose of the new CHEM 360 is to provide general PD training that can apply to any career pathway that students choose.

This general PD training is offered to sophomores and first-semester juniors in order to affect students’ pursuit of EL during their undergraduate careers, whereas CHEM 401 instruction is directed toward students’ post-graduations plans. Although the focus on post-graduation plans is a long-term outcome of the new CHEM 360 course, it is not part of the immediate focus.

Another difference between CHEM 401 and the new CHEM 360 is the teaching logistics. Although both courses would meet once per week, the new CHEM 360 would be contained in a midday, 50-minute block, while CHEM 401 is offered in the evening for two hours. Six out of sixteen Spring 2018 students surveyed about CHEM 401 mentioned that the duration or time-of-day of the course would be a potential barrier to signing up.

One reason why it is possible to teach the new CHEM 360 during the day is because, unlike CHEM 401, this one-credit course can be taught by a teaching assistant using a quarter or half TA assignment. CHEM 401 is taught by a member of the chemical industry who comes to class after leaving work. (CHEM 401 used to be taught by a professor, then by a post-doctoral student, but this is no longer the case.\textsuperscript{54}) Although meeting for two hours in the three-credit CHEM 401 allows for more depth of information, the purpose of CHEM 360 is to turn students’ attention to as many PD topics as possible in one semester so that students can achieve a wide foundation that they can deepen individually throughout their undergraduate progression.

\textsuperscript{53} Honors College Website, 2018.
\textsuperscript{54} Drost, 2018.
Different from UNIV 101

USC was one of the first universities in the United States to offer an introductory course to freshmen or transfer students that outlines the University’s many resources for undergraduates. UNIV 101 encompasses a variety of general and major-specific sections provide freshman with a wide foundation about USC from its history to many student affairs services. Like UNIV 101, the new CHEM 360 introduces students to many on-campus resources, but the overall purpose of these resources is different.

UNIV 101 focuses on resources that help students become productive and knowledgeable members of the Carolina community, whereas the new CHEM 360 focuses on resources that help students become professional scientists. These resources center on transferable skills that help students obtain EL opportunities.

Similar to UNIV 201

The UNIV 201: Fundamentals of Integrative Learning series “integrates concrete experience with theoretical foundations by reflecting and applying information.” Many University offices can apply to host a UNIV 201 section in one of five categories: Work-based Experiential Education, Peer Leadership, Community Service, Global Learning, and Research. For example, the Office of Pre-Professional Advising hosts a Work-based Experiential Education entitled “Healthcare in Action,” in which students complete a number of physician shadowing hours and various reflections.

The general learning outcomes for the UNIV 201 are:

1. “Provide examples of beyond-the-classroom experiences in which [students] have engaged and describe how beyond-the-classroom experiences have contributed to their learning”
2. “Articulate examples of beyond-the-classroom experiences that illuminate concepts/theories/frameworks in their academic work including elements of the beyond-the-classroom experience that are consistent with or contradictory to the identified concept”
3. “Identify and analyze the significance of experiences including impact on personal actions or decisions and/or how lessons learned could be informative to others”
4. “Apply learning to make a plan for the future”

The new CHEM 360 course mirrors and supports these learning outcomes by building the PD foundation for student to pursue EL/beyond-the-classroom opportunities (see Figure 4, p.20). The first lesson on within- and beyond-the-classroom connections specifically addresses Learning Outcome 2. Learning Outcome 3 is addressed in “Learning Outcomes” on page 35, while Learning Outcome 4 is emphasized throughout the course but mostly in the “Applying Yourself” module that challenges students to outline their future EL plans.

55 “University 101 Programs.”
56 “University 201 Sample Course Descriptions.”
Summary and Lessons Learned
Throughout this course development, I have experienced an example of how curricula grow and change over time at a large research institution. I have also learned to ensure that any intervention should first address what the Department needs at the moment before focusing on what I think that the Department needs. For example, priorities ranked higher than this project are reinstating senior exit interviews and redesigning a major-specific biochemistry laboratory course.

The experience has shown me to appreciate the many moving parts that go into maintaining a high caliber department, but this experience has also shown me how bureaucracy can stall growth and change. It was different in a science department for a student to focus on how we are teaching students instead of specifically what we are being taught.

Overall, I am glad to have had the support of the course instructor, and I am satisfied to have done all that I could over the duration of this project to provide well-crafted piece to the University puzzle.

Recommendations
In order to better serve chemistry and biochemistry majors in their professional development, I suggest the following future directions to the Department of Chemistry and Biochemistry at the University of South Carolina:

- Introduce professional development conversations into regular academic advising appointments
- Replace the previous undergraduate research requirement with an experiential learning requirement for 0-3 credit hours
- Offer the new CHEM 360: Undergraduate Seminar course to sophomores and first-semester juniors
- Encourage seniors and second-semester juniors to register for CHEM 401: Industry Capstone Experience
- Reinstate regular senior exit interviews
- Emphasize integrative learning
- Coordinate a professional development workshop series at least once per academic year for graduate students in Chemistry and Biochemistry

Limitations of the Project
This Senior Thesis project faced two major limitations: small participation from students and a restricted timeline.

Out of 697 majors registered in Chemistry and Biochemistry and Molecular Biology in Fall 2017, twenty-seven students completed the Professional Development Planning form (response rate=4.3%) and fourteen majors participated in the workshop series (participation rate=2%). This limited participation restricts how project findings are able
to correlate to the majority of undergraduates in the Department. This is acknowledged in the interpretation of the quantitative data from workshop post-surveys.

The duration of this Senior Thesis project was one year, during which the session planning and workshops were conducted. I believe that a longer timeline would have provided students with more time to participate in study interventions and allowed for more in depth analysis of the data.

Implications
The short-term implications of this project in advancing current efforts in professional development for undergraduate majors is to influence the curriculum by altering the purpose and format of CHEM 360: Undergraduate Seminar. Due to the removal of the research requirement for Biochemistry and Molecular Biology majors, CHEM 360 was found without a curriculum-warranted purpose. For this reason, the course will be changed to elective status for the next catalog. Whereas the course was offered every fall, it will now be more sparingly taught. However, the revitalized professional development course will be ready for implementation at its next offering.

Another effect on the curriculum should be to require in-house, direct professional development for students pursuing the ACS certification. Since PD is a part of the Guidelines, I think that the Department should uphold its importance by requiring PD for these students. It is up to us, however, to see this fault in ourselves because the certification is self-perpetuated, meaning that the ACS does not periodically review accepted programs.

In the long run, the goal of the workshop series is to affect departmental culture by directing students’ attention toward examples of experiential education beyond academic research and shadowing doctors. By introducing students to the world of professional development activities, the goal is to increase students’ use of their available resources on campus. As diversity of experiential education blossoms, I would like to hear of students sharing their experiences with their peers and encouraging a more investigative culture. This will direct students to take ownership of their education.

Beyond the single iteration of a workshop series, the original purpose of the Professional Development Planning form was for adding a PD element to academic advising, much like in the Department of Chemical Engineering. By having students complete and discuss a PDP each semester, advisors could keep abreast of students’ post-graduation plans as well as the next steps in achieving their goals. This planning form helped me stay on track for study abroad in a major that is typically completed entirely at the home university. I anticipate that the PDP would also help other students realize that they have more time and flexibility than is readily perceived in such a rigorous study. With proper

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57 Weidner, 2017.
form conversion and advisor training, professional development planning could become a functional reality for the Department of Chemistry and Biochemistry moving forward.

As more students begin to seek out professional development opportunities, I expect the Department of Chemistry and Biochemistry to formally expand their PD infrastructure. This increase in student PD involvement will not only come from realizations during this project, but also from the sheer increase in chemistry and biochemistry matriculates. It was the unabated biochemistry program growth that forced the removal of the research requirement and the elective status of CHEM 360. The Department’s organizational structure is unprepared for the requisite departmental changes that must accompany PD changes. However, “if [we] wait for perfect conditions, [we] will never get anything done.”

Finally, the purpose of professional development is to prepare students for the world of work and postgraduate studies. I hope and expect that this project will cause some students to begin to identify as professional scientists and other to realize that professional science is not for them. By accepting a “try-it-before-you-buy-it” mentality, students can stretch their experiential education to the limits and begin to take ownership of their future goals. When we make professional development a priority, our students will graduate with wisdom, not just knowledge. When we accomplish this goal, the next thing that we should do is set another goal.

**Supporting Documents**
The following section contains all of the surveys distributed over the life of this project as well as the example syllabus and two sample lesson plans for the new CHEM 360 course.

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59 Ecclesiastes 11:4.
Professional Development Plan

Professional Development Plan Fall 2017

The purpose of this form is learn about the professional interests of our undergraduate majors. We will use the data to provide you with professional development resources to help you reach your goals. Thank you for taking the time to invest in your future.

This project has been reviewed by the Institutional Review Board, a University entity that certifies that human research is ethically conducted. They have determined that the project does not constitute "human research," as this data is not used to add to a body of general knowledge.

* Required

1. USC email *

2. In which year did you begin college (at USC or elsewhere)? *
   Mark only one oval:
   - 2017
   - 2016
   - 2015
   - 2014
   - 2013 or earlier

3. Major *
   Mark only one oval:
   - Biochemistry and Molecular Biology
   - Chemistry
   - Other:

4. Minor (if applicable)

5. Other classifications (if applicable)
   Mark only one oval:
   - Honors College
   - Capstone Scholer
   - Other:
6. Career goals. Select your intended career track. Check all that apply. *

Check all that apply:

- Professional Practice
- Academia
- Industry
- Government Work
- Science Education/Outreach
- Other:

7. Current professional development activities. Only select what you are participating in this academic year (including Summer 2018).

Check all that apply:

- Internship
- Fellowship
- Academic Research
- Graduation with Leadership Distinction
- ACS Accreditation
- Study Abroad
- Service Learning/Community Service
- Student Organization Membership
- Peer Leadership (ex. Student Success Center employment, U101 peer TA, laboratory TA...)
- Grant Application
- Job Application (if related to your intended career track)
- Professional School Application
- Graduate School Application
- Other:

8. Past professional development activities. Select activities from previous years in college. (Students entering in 2017 may select activities from high school.)
   Check all that apply.
   [ ] Internship
   [ ] Fellowship
   [ ] Academic Research
   [ ] Graduation with Leadership Distinction
   [ ] ACS Accreditation
   [ ] Study Abroad
   [ ] Service Learning/Community Service
   [ ] Student Organization Membership
   [ ] Peer Leadership (ex. Student Success Center employment, U101 peer TA, laboratory TA...)
   [ ] Grant Application
   [ ] Job Application (if related to your intended career track)
   [ ] Professional School Application
   [ ] Graduate School Application
   [ ] Other:

9. Future professional development activities. Select activities that you would like to or are planning to pursue in the next two years.*
   Check all that apply.
   [ ] Internship
   [ ] Fellowship
   [ ] Academic Research
   [ ] Graduation with Leadership Distinction
   [ ] ACS Accreditation
   [ ] Study Abroad
   [ ] Service Learning/Community Service
   [ ] Student Organization Membership
   [ ] Peer Leadership (ex. Student Success Center employment, U101 peer TA, laboratory TA...)
   [ ] Grant Application
   [ ] Job Application (if related to your intended career track)
   [ ] Professional School Application
   [ ] Graduate School Application
   [ ] Other:
10. Select three topics that would be most beneficial to you in a seminar series on professional development for undergraduates.*
Check all that apply.

☐ Connecting extracurricular activities and academic learning
☐ Scientific communication to lay and peer audiences
☐ Resume/CV writing
☐ Interview and networking skills
☐ Writing applications and personal statements
☐ Hearing from professionals in various fields
☐ Research and professional practice ethics
☐ Other: ____________________________

11. Which time of day is most convenient for you to attend a 1-hour seminar? *
Mark only one oval.
☐ In between classes
☐ Early evening
☐ Other: ____________________________
Workshop Surveys

Workshop 1

Professional Development for Chemistry and Biochemistry Undergraduate Majors
Presenter: USC Connect
February 7, 2018
Workshop 1 of 5

<table>
<thead>
<tr>
<th>Questions about the presentation and activity</th>
<th>Not Met 1</th>
<th>Somewhat Met 2</th>
<th>Mostly Met 3</th>
<th>Met 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the scale above, were your expectations for this workshop met? Please explain.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Questions about experiential education</th>
<th>Not Relevant 1</th>
<th>Somewhat Relevant 2</th>
<th>Mostly Relevant 3</th>
<th>Very Relevant 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your own words, what is the difference between experiential education and classroom learning?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Questions about activity relevance</th>
<th>Not Relevant 1</th>
<th>Somewhat Relevant 2</th>
<th>Mostly Relevant 3</th>
<th>Very Relevant 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the scale above, how relevant was the activity to you? What was your main takeaway from the activity?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Questions about resources utilization | | |
|--------------------------------------| |
| Which resources from USC Connect will you utilize? |
Using the scale above, how important is experiential education to you?
Please explain.

Using the scale above, how do you feel that the Department of Chemistry and Biochemistry is supporting undergraduate experiential education (excluding this workshop series)?
Please explain.

Using the scale above, do you feel more prepared or less prepared to pursue experiential education?
Please explain.

<table>
<thead>
<tr>
<th>Demographic Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your major?</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>In which year did you enter your undergraduate studies?</td>
</tr>
<tr>
<td>How did you hear about this workshop? Circle all that apply.</td>
</tr>
<tr>
<td>Flyers in Jones/Coker</td>
</tr>
<tr>
<td>Biochemistry Club Social Media Post</td>
</tr>
</tbody>
</table>

Have any other comments? Write them in the space below.
Workshop 2

Resume/CV Writing for Chemistry and Biochemistry Undergraduate Majors
Presenter: Career Center
February 20, 2018
Workshop 2 of 5

Questions about the presentation and activity

<table>
<thead>
<tr>
<th>Not Met</th>
<th>Somewhat Met</th>
<th>Mostly Met</th>
<th>Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, were your expectations for this workshop met?
Please explain.

Not Relevant | Somewhat Relevant | Mostly Relevant | Very Relevant
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, how relevant was the presentation to you?
What was your main takeaway from the presentation?

Using the scale above, how relevant was the activity to you?
What was your main takeaway from the activity?

Which resources from the Career Center will you utilize?

Questions about building a resume
In your own words, what is the difference between a resume and a CV?
### Not a Priority 1 | Low Priority 2 | Medium Priority 3 | High Priority 4
---|---|---|---

Using the scale above, how important is experiential learning to you? Experiential learning takes place outside the classroom environment. Please explain.

### Not in Dept. | Very Poorly 1 | Poorly 2 | Well 3 | Very Well 4
---|---|---|---|---

Using the scale above, how do you feel that the Department of Chemistry and Biochemistry is supporting undergraduate experiential learning (excluding this workshop series)? Please explain.

### A lot less -2 | Less -1 | About the same 0 | More 1 | A lot more 2
---|---|---|---|---

Using the scale above, do you feel more prepared or less prepared to apply for job/schools? Please explain.

### Demographic Questions

**What is your major?**
- Chemistry
- Biochemistry
- Other

**In which year did you enter your undergraduate studies?**
- 2017/2018
- 2016
- 2015
- 2014
- 2013 and earlier

**How did you hear about this workshop?** Circle all that apply.
- Flyers in Jones/Coker
- Career Center
- Handshake Invitation
- UofSC Calendar Event
- CHEM/BIOCHEM Listserv Email
- Honors College Newsletter
- Honors College Pre-Med Announcement
- Biochemistry Club Social Media Post
- Biochemistry Club Announcement
- Arts and Sciences Digital Screens
- Other Attendees
- Other_____

**Have any other comments?** Write them in the space below.
Workshop 3

Interviewing and Networking Skills for Chemistry and Biochemistry Undergraduate Majors
Presenter: Career Center
February 28, 2018
Workshop 3 of 5

<table>
<thead>
<tr>
<th>Questions about the presentation and activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Met 1</td>
</tr>
<tr>
<td>Using the scale above, were your expectations for this workshop met? Please explain.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Questions about building interviewing and networking skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your own words, what is the difference between interviewing and networking?</td>
</tr>
</tbody>
</table>

Using the scale above, how relevant was the "Science Communication" presentation to you? What was your main takeaway from the "Science Communication" presentation?

Using the scale above, how relevant was the "Elevator Pitch" activity to you? What was your main takeaway from the "Elevator Pitch" activity?

Using the scale above, how relevant was the "Mastering Small Talk" presentation to you? What was your main takeaway from the "Mastering Small Talk" presentation?
<table>
<thead>
<tr>
<th>A lot less</th>
<th>Less</th>
<th>About the same</th>
<th>More</th>
<th>A lot more</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Using the scale above, do you feel more prepared or less prepared to engage in networking activities? Please explain.

<table>
<thead>
<tr>
<th>Not a Priority</th>
<th>Low Priority</th>
<th>Medium Priority</th>
<th>High Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, how important is experiential learning to you? Experiential learning takes place outside the classroom environment. Please explain.

<table>
<thead>
<tr>
<th>Not in Dept.</th>
<th>Very Poorly</th>
<th>Poorly</th>
<th>Well</th>
<th>Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Using the scale above, how do you feel that the Department of Chemistry and Biochemistry is supporting undergraduate experiential learning (excluding this workshop series)? Please explain.

Demographic Questions

What is your major?
- Chemistry
- Biochemistry
- Other:

In which year did you enter your undergraduate studies?
- 2017/2018
- 2016
- 2015
- 2014
- 2013 and earlier

How did you hear about this workshop? Circle all that apply.
- Flyers in Jones/Coker
- Career Center Handshake Invitation
- UofSC Calendar Event
- CHEM/BIOCHEM Listserv Email
- Honors College Newsletter
- Honors College Pre-Med Announcement
- Biochemistry Club Social Media Post
- Biochemistry Club Announcement
- Arts and Sciences Digital Screens
- Other Attendees
- Other:

Have any other comments? Write them in the space below.
Writing Personal Statements for Chemistry and Biochemistry Undergraduate Majors
Presenters: Office of Fellowship and Scholar Programs and Office of Pre-Professional Advising
March 20, 2019
Workshop 4 of 5

Questions about the presentation and activity

<table>
<thead>
<tr>
<th>Not Met</th>
<th>Somewhat Met</th>
<th>Mostly Met</th>
<th>Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, were your expectations for this workshop met?
Please explain.

<table>
<thead>
<tr>
<th>Not Relevant</th>
<th>Somewhat Relevant</th>
<th>Mostly Relevant</th>
<th>Very Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, how relevant was the "Writing Personal Statements" video to you?
What was your main takeaway from the "Writing Personal Statements" video?

Using the scale above, how relevant was the "Writing Personal Statements" activity to you?
What was your main takeaway from the "Writing Personal Statements" activity?

Questions about crafting personal statements

In your own words, what is the benefit of writing a personal statement?
<table>
<thead>
<tr>
<th>A lot less</th>
<th>Less</th>
<th>About the same</th>
<th>More</th>
<th>A lot more</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Using the scale above, do you feel more prepared or less prepared to write a personal statement?

Please explain.

<table>
<thead>
<tr>
<th>Not a Priority</th>
<th>Low Priority</th>
<th>Medium Priority</th>
<th>High Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, how important is experiential learning to you? Experiential learning takes place outside the classroom environment.

Please explain.

<table>
<thead>
<tr>
<th>Not in Dept.</th>
<th>Very Poorly</th>
<th>Poorly</th>
<th>Well</th>
<th>Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Using the scale above, how do you feel that the Department of Chemistry and Biochemistry is supporting undergraduate experiential learning (excluding this workshop series)?

Please explain.

### Demographic Questions

**What is your major?**

- Chemistry
- Biochemistry
- Other ____________

**In which year did you enter your undergraduate studies?**

|-----------|------|------|------|------------------|

**How did you hear about this workshop? Circle all that apply.**

- Flyers in Jones/Coker
- Career Center Handshake Invitation
- UofSC Calendar Event
- CHEM/BIOCHEM Listserv Email
- Honors College Newsletter
- Honors College Pre-Med Announcement
- Capstone Scholars Newsletter
- Biochemistry Club Social Media Post
- Biochemistry Club Announcement
- Arts and Sciences Digital Screens
- Other Attendees
- Other ____________

**Have any other comments? Write them in the space below.**
**Workshop 4.5**

Writing Personal Statements for Chemistry and Biochemistry Undergraduate Majors  
Presenters: Office of Fellowship and Scholar Programs and Office of Pre-Professional Advising  
April 9, 2018  
Workshop 4.5 of 5

<table>
<thead>
<tr>
<th>Questions about the presentation and discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Met</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Using the scale above, were your expectations for this workshop met? Please explain.

<table>
<thead>
<tr>
<th>Questions about the &quot;Writing Personal Statements&quot; video</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Relevant</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Using the scale above, how relevant was the "Writing Personal Statements" video to you? What was your main takeaway from the "Writing Personal Statements" video?

<table>
<thead>
<tr>
<th>Questions about the &quot;Writing Personal Statements&quot; discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Relevant</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Using the scale above, how relevant was the "Writing Personal Statements" discussion to you? What was your main takeaway from the "Writing Personal Statements" discussion?

<table>
<thead>
<tr>
<th>Questions about crafting personal statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your own words, what is the benefit of writing a personal statement?</td>
</tr>
<tr>
<td>A lot less -2</td>
</tr>
<tr>
<td>---------------</td>
</tr>
</tbody>
</table>

Using the scale above, do you feel more prepared or less prepared to write a personal statement? Please explain.

Questions about professional development
Which professional development activities have you participated in during college? Please circle your past or current activities only if they applied to your intended career path(s).

<table>
<thead>
<tr>
<th>Internship</th>
<th>Fellowship</th>
<th>Academic Research</th>
<th>Graduation with Leadership Distinction</th>
<th>ACS Accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Abroad</td>
<td>Service Learning/Community Service</td>
<td>Student Organization Membership</td>
<td>Peer Leadership</td>
<td>Grant Application</td>
</tr>
<tr>
<td>Job Application</td>
<td>Professional School Application</td>
<td>Graduate School Application</td>
<td>Other ________________</td>
<td></td>
</tr>
</tbody>
</table>

Please rank the top three professional development activities in order of importance for your intended career path. Please explain your rankings.
1 (most important)-

2-

3-

Demographic Questions
What is your major?
Chemistry | Biochemistry | Other ____________

In which year did you enter your undergraduate studies?

What is your intended career path? Circle all that apply.
Medicine | Pharmacy | Dentistry | Law |
Academia | STEM Education/Outreach | Chemical Industry | Government Work |

Other ________________

Have any other comments? Write them in the space below.
4/6 Resource Fair

Thank you for participating in the resource fair today. Please let us know what you think about the event. Your responses will be analyzed anonymously, so any personal information associated with completing this form will be removed. Please provide answers that accurately describe your thoughts.

Please show the completion message to the prize table attendant in order to collect your incentives.

* Required

1. What is your major? *
   Mark only one oval.
   - Chemistry
   - Biochemistry and Molecular Biology
   - Other: __________________________

2. What is your minor, if applicable?
   __________________________

3. In which year did you begin your undergraduate studies? *
   Mark only one oval.
   - 2017
   - 2016
   - 2015
   - 2014
   - 2013 or earlier
   - Other: __________________________

4. What is your intended career path? Select all that apply. *
   Check all that apply.
   - Academic Research
   - Chemical industry
   - Science education/outreach
   - Government work in science
   - Medicine
   - Pharmacy
   - Dentistry
   - Law
   - Other: __________________________

https://docs.google.com/forms/d/e/1FAIpQLSfmeG6aVq390bLc053gQJ5tqg16uXlo61AH87oGKQ
5. Which tables did you visit? *
   Check all that apply.
   - [ ] STEM Education
   - [ ] Pharmacy
   - [ ] Biochemistry club

6. As a result of this event, are you more or less confident to pursue your intended career path? *
   Mark only one oval per row.
   - [ ] Much less confident
   - [ ] Less confident
   - [ ] No change
   - [ ] More confident
   - [ ] Much more confident

7. How important is professional development to you? *
   Mark only one oval per row.
   - [ ] Not a priority
   - [ ] Low priority
   - [ ] Medium priority
   - [ ] High priority

8. Please explain. *

9. How do you think the Department of Chemistry and Biochemistry supports professional development for undergraduates? *
   Mark only one oval per row.
   - [ ] Not in department
   - [ ] Very poorly
   - [ ] Poorly
   - [ ] Well
   - [ ] Very well

10. Please explain *

11. What are your perceived barriers to participating in professional development events? *
   Check all that apply:
   - [ ] Professional development is not a priority
   - [ ] I have little time to attend
   - [ ] Events offered are not relevant to me
   - [ ] I have other commitments
   - [ ] I don’t know when the events are happening
   - [ ] Other:

https://docs.google.com/forms/d/1/yA juvenileEli4_VsPQ3FwFvLeLitggi46nU6i1AUOjw2t
12. Do you have any other comments?


Powered by

Google Forms

https://docs.google.com/forms/d/1/ya_Jv02m1GEkt-VFPQjFwILc_8msgjY6zXz61AU30/edit
### New CHEM 360 Syllabus

**Syllabus Template for M Course Schedule, with Fall 2018**
**USC Academic Master Calendar dates**

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
<th>Assignment</th>
<th>Due Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M, 8/27</td>
<td>Introduction</td>
<td>Expectations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>W, 8/29</strong> Last day to change/drop a course without a grade of “W” being recorded</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Labor Day Holiday</strong></td>
<td>9/3</td>
<td>No Classes</td>
</tr>
<tr>
<td></td>
<td><strong>2</strong></td>
<td>M, 9/10</td>
<td>USC Connect: WTC and BTC</td>
<td>Making Connections</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>F, 9/14</strong> Last Day to Apply for December Graduation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>3</strong></td>
<td>M, 9/17</td>
<td>LSC: Workplace Big 5</td>
<td>Class distribution</td>
</tr>
<tr>
<td></td>
<td><strong>4</strong></td>
<td>M, 9/24</td>
<td>Career Center: Career Pathways Introduce Module 2</td>
<td>WPBS self reflection</td>
</tr>
<tr>
<td></td>
<td><strong>5</strong></td>
<td>M, 10/1</td>
<td>Career Center: Resume Workshop</td>
<td>Target or develop resume</td>
</tr>
<tr>
<td></td>
<td><strong>6</strong></td>
<td>M, 10/8</td>
<td>Career Center: Interview Types</td>
<td>Question list for informal interview</td>
</tr>
<tr>
<td></td>
<td><strong>7</strong></td>
<td>M, 10/15</td>
<td>Career Center: Social Media</td>
<td>Make LinkedIn Profile</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>M, 10/15</strong> Last day to drop without “WF” being recorded</td>
<td>Semester Midpoint</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>8</strong></td>
<td>M, 10/22</td>
<td>Introduce Module 3 OFSP/CC/OOR/USC Connect: Discover Opportunities</td>
<td>Make EL/BTC timeline</td>
</tr>
<tr>
<td></td>
<td><strong>9</strong></td>
<td>M, 10/29</td>
<td>OUR: Obtaining Opportunities</td>
<td>Draft “first email”</td>
</tr>
<tr>
<td></td>
<td><strong>10</strong></td>
<td>M, 11/5</td>
<td>OUR/CC: Letters of Recommendation</td>
<td>List recommenders</td>
</tr>
</tbody>
</table>

**Fall Break** 10/18-10/19  No Classes
<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
<th>Assignment</th>
<th>Due Today</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Introduce Module 4 and types</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General Election Day</td>
<td>T, 11/6</td>
<td>No Classes</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>M, 11/12</td>
<td>ASBMB/ACS/TEDx: Non-Scientist Interactions</td>
<td>8th-grade level explanations</td>
<td>BCC of REC “first email”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Application Sent</td>
</tr>
<tr>
<td>12</td>
<td>M, 11/19</td>
<td>Elevator Pitch</td>
<td>Practice elevator pitch</td>
<td>Verified 8th-grade level explanation</td>
</tr>
<tr>
<td></td>
<td>Thanksgiving Recess</td>
<td>11/21-11/25</td>
<td>No Classes</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>M, 11/26</td>
<td>Making Slides</td>
<td>Create group presentation</td>
<td>Elevator pitch</td>
</tr>
<tr>
<td>14</td>
<td>M, 12/3</td>
<td>Group Presentations</td>
<td>Review peers</td>
<td>Completed group presentation</td>
</tr>
<tr>
<td></td>
<td>F, 12/7</td>
<td>Last day of Class</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sa, 12/8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M, 12/10 - M, 12/17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Learning Outcomes:

Upon successful completion of the course, students should be able to:

1. Understand how classroom learning connects to experiential learning
2. Understand how work environments function and how students function within work environments
3. Communicate science and self clearly and concisely to diverse audiences
## New CHEM 360 Sample Lesson Plans

### Workplace Big 5

<table>
<thead>
<tr>
<th>Part</th>
<th>Instructional Content (Title or Topic with Notes)</th>
<th>Time (Minutes)</th>
<th>Assessment or Activity Interaction (Include Technology Needed)</th>
<th>Time (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduce LSC with location and overview of services</td>
<td>10</td>
<td>• Overview of services (handouts) • Viewing and navigating website (Projector)</td>
<td>Inc.</td>
</tr>
<tr>
<td>2</td>
<td>LSC introduce WPBS with purpose and main traits</td>
<td>7</td>
<td>• Students listen to lecture • Students receive</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>LSC facilitate exercise of where class members fall on spectra</td>
<td>25</td>
<td>• Students move around classroom and stand along number line (printed numbers)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Discuss importance of reflection</td>
<td>8</td>
<td>• Students reflect on agreements and disagreements with WPBS (worksheet)</td>
<td>HMWK</td>
</tr>
</tbody>
</table>

---

*Center for Teaching Excellence*  
sc.edu/cte  
cte@jsc.edu  
883-777-8322
CHEM 360: Undergraduate Seminar
Week 3: Connecting Yourself Module 2
Workplace Big 5: Leadership and Service Center
Reflection

Name__________________________
Date__________________________

1. Why do you agree/disagree with your Need for Stability result?

2. Why do you agree/disagree with your Extraversion result?

3. Why do you agree/disagree with your Originality result?

4. Why do you agree/disagree with your Accommodation result?

5. Why do you agree/disagree with your Consolidation result?

6. Why do you agree/disagree with one of the 23 minor trait results? __________________________

__________________________
### Resume

**CHEM 360: Undergraduate Seminar**  
**Week 5: Marketing Yourself Module 1**  
**Resume: Career Center**  
**50 minutes**

<table>
<thead>
<tr>
<th>Part</th>
<th>Instructional Content (Title or Topic with Notes)</th>
<th>Time (Minutes)</th>
<th>Assessment or Activity Interaction (Include Technology Needed)</th>
<th>Time (Minutes)</th>
</tr>
</thead>
</table>
| 1    | Introduction of Career Center with location and overview of services | 10             | ▪ Overview of services (handouts)  
▪ Viewing and navigating website (Projector) |                |
| 2    | Purpose of resume and how hiring managers use them  
▪ Time dedicated to managers’ review  
▪ Traits and words they look for | 10             | ▪ Students listen to lecture (projector) |                |
| 3    | For having resume: Technique to target and answering specific questions  
For starting resume: Crafting bullets for experiences | 25             | ▪ Students divide into groups  
▪ One CC facilitator per group to work on resume (laptops - check out cart of computers) |                |
| 4    | Assign drop-in to review resume | 5              | ▪ Students will visit CC to talk with resume coach and upload product to Handshake (printed copy of resume) |                |
# Survey to the CHEM 401 Class

## Students

Opinions about CHEM 401  
**Student Version**  
April 2, 2018

<table>
<thead>
<tr>
<th>Demographic Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is your major?</td>
</tr>
<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>In which year did you enter your undergraduate studies?</td>
</tr>
<tr>
<td>What is your intended career path?</td>
</tr>
<tr>
<td>Medicine</td>
</tr>
<tr>
<td>Academia</td>
</tr>
<tr>
<td>Other ___________________</td>
</tr>
</tbody>
</table>

## Questions about CHEM 401

<table>
<thead>
<tr>
<th></th>
<th>Not Met</th>
<th>Somewhat Met</th>
<th>Mostly Met</th>
<th>Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Using the scale above, were your expectations for this course met?  
Please explain.

What are potential barriers to enrollment in CHEM 401?  
For example, think about some of your tradeoffs for taking this course.
<table>
<thead>
<tr>
<th>A lot less</th>
<th>Less</th>
<th>About the same</th>
<th>More</th>
<th>A lot more</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Using the scale above, do you feel more prepared or less prepared to pursue your intended career path? Please explain.

Questions about experiential learning
In your own words, what is the benefit of experiential learning? Experiential learning takes place outside the classroom environment.

<table>
<thead>
<tr>
<th>Not a Priority</th>
<th>Low Priority</th>
<th>Medium Priority</th>
<th>High Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, how important is experiential learning to you? Please explain.

<table>
<thead>
<tr>
<th>Not in Dept.</th>
<th>Very Poorly</th>
<th>Poorly</th>
<th>Well</th>
<th>Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Using the scale above, how do you feel that the Department of Chemistry and Biochemistry is supporting undergraduate experiential learning? Please explain.

Have any other comments? Write them in the space below.
**Instructor**

**Opinions about CHEM 401**

**Instructor Version**

April 2, 2018

<table>
<thead>
<tr>
<th>Demographic Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>How many years (and semesters, total) have you taught CHEM 401?</td>
</tr>
</tbody>
</table>

**Why did you accept the request to teach CHEM 401?**

**What have been your expectations of teaching CHEM 401?**

<table>
<thead>
<tr>
<th>Not Met</th>
<th>Somewhat Met</th>
<th>Mostly Met</th>
<th>Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Using the scale above, were your expectations for teaching CHEM 401 met?

Please explain.

**Questions about CHEM 401**

**What have been the general enrollment trends over time?**

Please provide insight into number of students and distribution of academic progression (juniors, seniors, graduate students).

**What changes have you implemented over time?**
What are potential barriers to enrollment in CHEM 401?
For example, think about students’ tradeoffs for taking this course.

Questions about experiential learning
In your own words, what is the benefit of experiential learning? Experiential learning takes place outside the classroom environment.

<table>
<thead>
<tr>
<th>Not a Priority 1</th>
<th>Low Priority 2</th>
<th>Medium Priority 3</th>
<th>High Priority 4</th>
</tr>
</thead>
</table>
Using the scale above, how important is experiential learning to you?
Please explain.

<table>
<thead>
<tr>
<th>Not in Dept.</th>
<th>Very Poorly 1</th>
<th>Poorly 2</th>
<th>Well 3</th>
<th>Very Well 4</th>
</tr>
</thead>
</table>
Using the scale above, how do you feel that the Department of Chemistry and Biochemistry is supporting undergraduate experiential learning?
Please explain.

Have any other comments? Write them in the space below.
Bibliography

5. Department of Chemistry and Biochemistry, University of South Carolina. www.sc.edu/study/colleges_schools/chemistry_and_biochemistry/study/undergraduate/
6. “Guidelines for Advisement 2013.” Office of Academic Affairs and Advising, College of Arts and Sciences, University of South Carolina, 2013.
7. Lovelace, Leslie. Interview on implementing professional development in academic advising within the Department of Chemistry and Biochemistry at the University of South Carolina, 2017.
8. Department of Chemistry and Biochemistry, University of South Carolina. www.sc.edu/study/colleges_schools/chemistry_and_biochemistry/study/undergraduate/
11. Outten, F. Wayne. Interview on the state of ASBMB and ACS accreditations at the University of South Carolina, 2018.
14. Ibid.
16. Ibid.


20. Lovelace, Leslie. Interview on implementing professional development in academic advising within the Department of Chemistry and Biochemistry at the University of South Carolina, 2017.

21. Shimizu, Ken. Interview on curriculum changes in the Department of Chemistry and Biochemistry at the University of South Carolina, 2017.

22. “Guidelines for Advisement 2013.” Office of Academic Affairs and Advising, College of Arts and Sciences, University of South Carolina, 2013.

23. “Guidelines for Advisement 2015.” Office of Academic Affairs and Advising, College of Arts and Sciences, University of South Carolina, 2015.

24. “Major Map: Chemistry – Bachelor of Science in Chemistry (B.S.C.).” Department of Chemistry and Biochemistry, University of South Carolina, 2017. p. 2.


28. Lovelace, Leslie. Interview on implementing professional development in academic advising within the Department of Chemistry and Biochemistry at the University of South Carolina, 2017.


31. Morgan, Stephen. Interview on the origins of CHEM 401, the IAB, and the ACS accreditation, 2018.


34. Suarez, Stephanie. Interview on services offered by the Leadership and Service Center at USC, 2017.

35. Rombach, Nicole. Interview on potential freshman involvement in professional development, 2017.


44. Lovelace, Leslie. Interview on implementing professional development in academic advising within the Department of Chemistry and Biochemistry at the University of South Carolina, 2017.


51. Fallucca, Amber. Interview on integrative learning initiatives at the University of South Carolina, 2017.


55. “University 101 Programs.” University of South Carolina.
   http://www.sc.edu/univ101/courses/pdf/University%20101%20Programs%20Flyer%20(Sizing%20Test).pdf
56. “University 201 Sample Course Descriptions.” University of South Carolina.
   http://www.sc.edu/univ101/courses/univ201.html