

KU BEARS Final Report – Summer 2018

There were 26 faculty and 31 students involved in the second year of KU BEARS. All the faculty stated that they would involve students again in research and all of the students stated that they would participate in research again if provided the opportunity.

Below are questions and summaries from the final reports submitted.

Questions that the Student Answered

How has this experience contributed to your undergraduate education and your life goals?

Main points students discussed in the reports:

- Developed research skills
- Greater appreciation of research
- Gained experienced that could not be obtained in the classroom
- Greater understanding of high-level equipment
- Made connections between lecture and its application
- Better prepared for graduate studies
- Confidence and motivation to conduct research
- Connecting and communicating with other researchers
- Decided to continue research after graduation

Quotes from students:

“This research has definitely given me an advantage as an undergrad. The experiences and skills I learned will be very useful for research opportunities I take on in the future. I learned about connecting and communicating with other researchers, particularly young students like myself, presentation skills and educating myself on unfamiliar topics.”

“This research experience has greatly affected and improved my undergraduate experience. Not only did it improve my relationship with a specific professor, it allowed me to learn concrete lab skills that I will be able to use for the rest of my professional life.”

“My research experience at Kutztown has significantly impacted my career choices and life goals. I found that I enjoyed working in a lab and realized that I could do this as a career.”

“The research that I participated in provided me with invaluable experience directly related to biochemistry and has helped me to prepare to apply for graduate school while strengthening my skill set as a scientist.”

“I learned more about general scientific procedures such as maintaining a scientific notebook, designing experiments, as well as analyzing results and determining further experiments from the results. Overall, the research I conducted over the summer, thanks to this grant, further developed my scientific skills and built my competence in completing procedures, different common techniques, and designing experiments to answer research questions.”

“I believe that research was the most important experience I have taken part of in my undergraduate career and is the most valuable education I have received at Kutztown.”

“The experience will certainly help me achieve my life goals as I want to go to graduate school to earn a PhD and work as a research professor.”

“This experience contributed to my undergraduate education by giving me an opportunity to work with programs and applications that I haven’t had opportunities to work with outside of the classroom.”

“Through this experience, many techniques that I learned in the past were reinforced. In addition, I learned a plethora of new advanced techniques. This experience truly allowed me to grow as a student and develop as a researcher.”

“This project forced me to apply my knowledge to an actual research project, allowing me to gain a realistic perspective of a particular career direction after college. This has helped me evaluate my life goals and better plan for my academic career beyond Kutztown University. I now have a true experience with working as part of a research team in the laboratory, and realize this is a career path I want to pursue.”

“This experience has made my undergraduate education fuller and more challenging. Because I’ve been able to participate in this summer research, I have a deeper understanding of the research process. It has enhanced my research skills, which will benefit me as I perform research throughout the rest of my undergraduate career and pursue further degrees.”

“Seeing the real-life impact of doing research like this has inspired me to teach my future students about what it means to do purposeful research and contribute to a field of study.”

“This project has provided me a chance to gain research experience in a field I’m interested in and has helped to solidify my career goals.”

What experiences will you take from this summer's research that will impact your future in education, research, or professional career?

Main points students discussed in the reports:

- Be prepared
- How to be a better writer
- Presenting at a national conference
- Note taking skills
- Patience
- Flexibility
- Professional connections
- Critical thinking
- Problem solving
- Knowledge and experience to continue to conduct research
- Collecting, analyzing and interpreting data
- Laboratory techniques
- Research techniques and methods
- Modifying/Changing methods when needed
- Survey development and implementation
- Teamwork

Quotes from students:

“My vision of teaching prior to this experience was very cut and dry. You go to school, engage students in lessons and go home for the day. My experience in Africa has made me think so much more into teaching. The children have taught me that teaching is so much more than lessons and grades. Teaching is compassion, resilience, and heart.”

“The experiences I had working in the lab were really good for me to get comfortable and familiar with lab research, communicating and working together with multiple people, and learning about my interests with research.”

“I learned how to properly conduct myself in a lab setting and how to effectively conduct research.”

“I very much enjoy doing research and plan to do more. I’ve learned skills I wouldn’t have had the opportunity to delve into otherwise.”

“This summer I learned how to deal with constant failure and how to try and figure out what is going wrong in the process and how to try and fix it. I did not expect quite as many issues that we ran into, but I did learn how to deal with situations such as these and how to change project goals around these issues.”

“The exposure I had to research and new skills I learned will give me a competitive edge in my future and will be a strong point in a resume as I apply to graduate school and in my professional career.”

“The most cherished aspect of the experience for me was the opportunity to collaborate with an expert and learn from him. I think this experience of collaboration will help me in graduate school as well as later in my career where I will certainly have to collaborate with colleagues on papers and projects.”

“The biggest experience from this summer’s research that will impact my future will be understanding how future projects I may be working on will be structured. Having the opportunity to work with a professor outside on my major’s concentration showed how research can be a learning process for everyone involved, as there may not always be clear answers to every step in the processes of research.”

“One of the biggest takeaways for me from this summer was learning how to be patient. This experience allowed me to get a glimpse of what “real research” is like – it certainly takes a lot of time, energy, frustration, and ultimately determination to keep working on the task at hand. This is especially relevant if I pursue higher education, but learning patience is a valuable lesson overall for any aspect of life.”

“The experience that impacted me the most was properly preparing for the project in the beginning and then being able to pull away during an experiment and admit ‘this is not working out,’ and finding an alternative.”

“I have gained an understanding of how to work with others as a team when conducting research and completing data analysis.”

“Through this experience, I have come to realize that research is often times not a quick and easy approach to solve problems. Learning this lesson early on will be very beneficial as I continue my career as a student and later in my professional career. Conducting research requires a huge amount of discipline, persistence and hard work.”

“This research experience has taught me that being patient is necessary with any sort of research because there are always going to be unexpected results, which need new ways of interpretation.”

Has the research experience met your expectations? Why or why not?

Quotes from students:

“I would say that this experience more than met my expectations simply on the basis that I didn’t expect to present at a conference. This being my first time participating in research, this experience helped me to develop an independent procedure of how to conduct similar experiments of my own.”

“This research experience far exceeded my expectations. In most lab settings, the student is told what to do and exactly how to do it. In this case, I was the one determining what to test and how. I was the one recognizing flaws in my experimental setup and imagining ways in which I could improve it. In general, this summer research gave me the confidence to ask and answer my own questions and to simply think critically, both of which are invaluable skills.”

“The research has met my expectations and beyond.”

“The opportunity given through the KU BEARS grant was an invaluable experience that strengthened my abilities and competency as a student and as a scientist that I would have not experienced in just classes alone.”

“This experience has met my expectations for working as a research assistant. This opportunity has made me feel confident in conducting my own research outside the classroom environment.”

“Yes, the research experience met my expectations. This was a unique opportunity that would not have been possible without the grant, so I am very grateful.”

“This experience has gone above and beyond my expectations.”

“The research experience has exceeded my expectations. I think I benefitted tremendously in improving my intellectual ability to carry out complex experiments and to solve difficult problems.”

“Yes, this research experience has met my expectations because it gave me a good sense of what it is like to work in a lab-setting and be able to create your own process of going about things instead of just following a typical lab handout within a course.”

“This research experience has met my expectations. I feel that I have been able to contribute to this project significantly, and it is my first time being the co-author of a future publication.”

“This research experience has exceeded my expectations: not only have I further developed research skills such as planning, data analysis, and attention to detail, I’ve been invited to publish my findings on a scholarly blog.”

“This research experience exceeded my expectations. It made me a lot more comfortable with research.”

“This research has met my expectations. I gained valuable experience and reinforced the knowledge I learned in class. I am enjoying summarizing my research results and look forward to presenting my final results at a conference.”

Would you participate in research again if given the opportunity? Why or Why not? What skills do you think you developed or strengthened through the research experience?

All students indicated that they would participate again if given the opportunity.

Skills developed or strengthened:

- Critical thinking
- Problem solving
- Time management
- Responsibility
- Organization
- Attention to detail
- Information literacy
- Coding data
- Data analysis and computational skills
- Computer programming
- Leadership
- Confidence
- Formulating a research question to answer
- Communication

- Proposal writing for a conference presentation
- Presentation skills
- Research techniques specific to the field
- Techniques and procedures for equipment
- Reading literature and extracting information needed

Quotes from students:

“I would most certainly participate in research again, seeing as research is something scientists will always have to do in addition to the fact that I wholeheartedly enjoy learning through research experience.”

“I can say that this research opportunity finally provided me with a positive outlook on a future career in the environmental sciences.”

“If given the opportunity again, I would most definitely participate in another research experience. The lessons I learned from doing independent research are invaluable and I know that if I did it again, I would only learn more.”

“The skills I learned from this research experience are numerous and extremely important. All of these skills will help me excel in my classes at KU and beyond. The most important skill I learned/improved throughout this research experience was critical thinking.”

“I would absolutely participate in research again and continue research if given the opportunity. I feel that the experience I have from conducting research is invaluable and cannot be obtained in the classroom.”

“I would be honored and greatly pleased to participate in another research program.”

“If given the opportunity to participate in research again, I would because the experiences that working on research gives you is extremely beneficial to a future career.”

“I was able to strengthen my problem-solving skills as this research was a learning process that involved many steps of trial and error.”

“I would love to participate in research again. The training that I had over the summer will assist me for the rest of my life, and I learned as much in those short weeks as I usually do in one semester.”

“My research skills (and patience) were honed as many hours were spent reading through different articles, whether it was at the beginning to create the method, or to understand why a part of our experimental method was not working.”

“I would definitely participate in a research project again if given the opportunity. I hope to improve my data analysis skills as well as my overall knowledge as I continue this research during the academic year.”

“I would participate in research again if given the opportunity. I lacked confidence in myself and if I was more patient in taking my time and being careful or taking time to ask questions, I think I would have been more confident in myself and abilities in the lab. This is something I would want to work on.”

“I would also like to develop my skills I have been learning as a researcher, such as using different microbiology equipment and techniques and handling micro-organisms such as bacteria and fungi.”

“If given the opportunity, I would do research in a heartbeat because I think research is something every student should experience before graduation.”

“If given the opportunity, I would participate in research again. There are skills that I would like to work on improving as a researcher such as time management, more organized data collecting, and patience.”

“I would participate in research again because I believe that research in my field is an essential part of being a student and can lead to great opportunities post-graduation.”

“I would definitely participate in research again if given the opportunity. This opportunity challenged me to develop the knowledge and skills necessary to contribute to active research.”

“I would, without a hint of hesitation, jump at another chance to participate in research time and time again. Everything that has come from this summer’s work has been beneficial to me in one way or another. My mentors did a commendable job guiding us through a real research process and pushing us to maintain proper practices. What has happened this summer was an unforgettable experience of a lifetime that I am gracious to have had the opportunity to partake in as an undergrad.”

Questions that the Faculty Member Answered

What skills did the student learn, what skills did they obtain, and can the student demonstrate those skills?

- Students learned more about the research process; skills and techniques needed for research in their selected fields of study; how to use equipment; and programming.
- Increasing ability and confidence in using literature search engines and reading literature
- Obtaining data, analyzing data and formulating results and conclusions
- Statistical and computational skills
- Data organizing and archiving
- Record keeping
- Problem solving
- Scientific writing
- Experimental design and modification
- Scientific methods
- Critical thinking
- Troubleshooting
- Critical reading
- Organization
- Leadership
- Collaboration
- Decision making
- Project management
- Communication skills

Quotes from faculty:

“Research projects do not have straightforward, ‘closed’ solutions like class assignments do. That is, unlike a class assignment that are generally structure around a set of precise procedures, research projects are largely unstructured. Therefore, it’s up to the researcher to critically evaluate the goals of the project and develop/utilize the appropriate strategy. On occasion, this may also require learning new techniques, which the student had to do to accomplish research tasks.”

“Overall, I am confident that the biggest value of the student’s experience was the ability to utilize the skills acquired in her classwork on a real research project before graduation.

There is a drastic difference between following a set of prescribed procedures in an assignment and solving a research goal on your own. In this regard, the student has honed her critical thinking and research skills through the research experience.”

“The student gained a great deal of experience in searching for appropriate journal articles as well as how to ‘breakdown’ the articles to efficiently find applicable information to our project.”

“Other more general scientific skills that the student obtained was a greater understanding for the importance of keeping an accurate and up-to-date notebook.”

“It was evident that both students significantly improved their critical thinking and problem-solving skills while working on their research project.”

“The student learned scholarly conventions for preparing transcriptions; she further became acquainted with specific scholarly resources used for transcription and quickly achieved a level of mastery with using these resources.”

“They learned how to collaborate with cultural insiders to ensure that materials are truly culturally responsive and how to assess both the efficacy of these materials with primary students as well as how to guide peers with less experience in working with young students from another culture.”

“My students learned a great deal about keeping proper records, statistical analysis of data, and scientific communication.”

“The student also had an opportunity to strengthen public speaking, interpersonal communication, and inter-professional collaboration skills. This student can evidently demonstrate all the mentioned skills.”

Would you involve an undergraduate student again in your research? Why or Why not?

All faculty indicated that they would involve students again in research. One faculty member stated that working with a student on research was more time consuming than originally anticipated and may have to rethink the type of projects they do with students.

Quotes from faculty:

“I would certainly work with an undergraduate student again. I find such work rewarding both to me and to the students, who are exposed to ways of thinking that typical classes may not touch on. Students are a productive part of my lab, and I rely on and trust them to be thoughtful scientists.”

“Mentoring the student in research and seeing him develop as a scientist was very rewarding. Having the large uninterrupted blocks of time for research in the summer enables students to mature from “trainees” to productive and independent collaborators. And when students develop this independence, they free me to work on other aspects of the research which enhances my productivity. I would certainly involve undergraduate students in my research again.”

“Absolutely! The amazing part about doing research with a student is seeing how far they come not only in the content knowledge, but in the confidence that they gain in themselves. Helping to facilitate this transformation in undergraduates is what teaching and researching at a PUI is truly all about!”

“For me including students serves three roles: 1) it trains the future cohort of researchers by giving them formal training in basic research design and methodology; 2) it connects students with the larger scientific community; and 3) it benefits the quality of my research. While it is certainly time consuming to train students for research, doing so ensures that I have carefully thought over all of the minutia involved in research design and often allows me to find important design flaws that I may have overlooked in earlier phases of research development.”

“Yes, I definitely would involve an undergraduate student in research in the future. I enjoy teaching students the skills needed to succeed in field research and mentoring them through the early stages of their career. Through this direct one-on-one experience, students are able to learn and mature as a scientist at a much faster rate than students who only work in the classroom.”

“Yes, absolutely! I feel like my students learned so much from being involved in this action research and that they will be stronger teachers and curriculum developers as a result.”

“This was my second time involving undergrads in my research and I was very pleased with the experience once again. On an exciting note, we are presenting our research at an international conference.”

“Yes, I would definitely involve another undergraduate student in my research as I enjoy sharing my knowledge and passion for plant pathology and research in general with undergraduate students. They bring so much to the project, especially their enthusiasm, creativity and critical thinking abilities. It’s also very rewarding to see them transmit their knowledge and discuss their research in meetings and conferences.”

“I would absolutely involve more students in my research. This project, in general, can be expanded in many ways and I look forward to other students jumping on board and working with a different part of the model. I’m happy to give students a leg up on the competition when it comes time to apply to graduate schools.”

“I would certainly involve undergraduate students in research again. It is important to give students a chance to conduct research, not only to promote active scientific exploration, but to help students further themselves professionally. This prepares them for life after college, and ultimately makes them better scientists, whether in graduate school or in a profession. Undergraduate research is one of the most productive ways of educating students and fostering their interest in areas of science.”

“I am a strong believer in almost everything there is no substitute for experience. Undergraduate research is an invaluable way for students to gain experience in the application of scientific principles in a way that is nearly impossible to replicate in the classroom. I would definitely involve undergraduates in research in as many avenues as possible to share that experience. Students of almost all academic levels can benefit from the hands-on experience gained by participating, in various capacities, in undergraduate research.”