CURE High School Program
Center for Biophotonics Science and Technology

Student Impacts Summative Evaluation Report

Inverness Research
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I. Background about this Evaluation

Introduction and Purpose:

In Spring 2011, Inverness Research Associates was hired to do a summative evaluation of the project, focusing on the students' experiences, ratings and reflections about the project, as well as their current educational and career trajectories.

The aim of this evaluation is to provide an external perspective on the extent to which and ways in which the CURE program has influenced or impacted high school participants in the four cohorts. The evaluation is focused solely on the students. The approach was designed to gather *quantitative and qualitative data* through *surveys and interviews*, resulting in ratings and measures of impact on participants as well as descriptive portrayals of participant experiences and reflections (through vignettes).

Any or all of this report is intended for use by the project leadership for the purpose of supporting their report and publication writing efforts. With this in mind, the report focuses on key results that emerged for us, with additional survey data provided in the appendix.

Evaluation Questions investigated include:

(1) In what ways and to what extent has the CURE program influenced participants'?

a. perceptions of themselves in relation to STEM fields and careers?
b. choices they have made and plan to make regarding their education and careers?
c. academic achievement(s)?

(2) How do current and past participants rate program experiences and components with respect to effectiveness and impact?

(3) What are key findings in terms of what participants learned through their participation in the program?

Working with Project staff, evaluators generated invitations offering modest incentives to recruit students who would take an online survey about the project, and who would be willing to participate in a structured phone interview.

Data Sources:

Our study focused on two primary sources of data.

(1) Online Survey (n=41: 79 participants from four cohorts invited; response rate of 52%). In June 2011 we posted an online survey, developed in

collaboration with Project leadership. Project staff also supported recruiting respondents from all student cohorts. The online survey remained opened until August 2011.

(2) Structured interviews (n=15: four from cohort 1; three from cohort 2; five from cohort 3; and three from cohort 4). All students who were interviewed also took the survey. Interview data was inputted into a SurveyMonkey response form and analyzed using a coding system. Codes were identified through a debriefing meeting where researchers summarized responses for each interviewee.

We also reviewed project documents, presentations and interview transcripts from prior project years and work.

Report Organization

Key findings reported from this study are presented in three main sections. The first section presents key results from the online survey; the second section presents key themes that emerged through the students' interviews; and in the third section we present three student vignettes exemplifying student experiences and impacts, concluding the report with some summary comments. Student quotes included in this report from open-ended survey responses and from interviews have been slightly edited for grammar.

II. Key Findings from Online Survey

Survey Instrument

The online survey was developed in collaboration with the project leadership and is attached as Appendix A. The survey was posted in May 2011 and open for three months.

Response Rates – 42 CURE students responded to the survey, a 53% response rate. The group of students with the highest survey response rates was the CURE participants with the most intensive experience, Group III. 84% of survey respondents were those students who participated in the academic year program, 3-week summer CBST "guided" research program and also an internship experience. Half of the survey participants experienced the academic year class at their school and the summer CBST 3-week research program responded, and one quarter of the students who responded only experienced the academic class program responded to the survey.

Introduction about the three subgroups used for analysis:
To determine the relationship between the kinds of experiences the students had in the program with their current status, goals and academic and career goals, survey

participants were organized into three sub-groups which we numbered in order of the intensity of their research experiences with the program[1]:

Group I – Students experienced only the academic course at their high school.
Group II – Students experienced the academic course and also the three-week summer guided research program.
Group III – Students had the most varied and intensive experiences. Students categorized into Group III participated in the academic course, the three-week CBST guided research project, and also a cancer internship.

Sixteen survey participants fell into Group III, 18 survey participants were in Group II, and 8 in Group I. Analyses of the survey responses and charts included in this report are consistently presented in terms of these three subgroups, with Group III typically reported first, then II, and then I.

Key Findings

Following are selected findings from the survey results. For the entire data set, please see the excel workbook (Appendix B) which is organized to report responses to all questions and open-ended responses according to the three subgroups (described earlier). Short summary statements with some accompanying charts are included in this section.

Current educational status:
Though 12% of the respondents are still in high school, of those that responded that have completed high school, 21% are in two-year colleges (community or trade colleges), 60% are currently attending four-year colleges, and 7% we don't know. Overall 81% are attending a postsecondary institution, and only 7% are not in school.

Current status:

CURE program experience

[1] These groups were determined after the first analysis of the survey data results, and was determined by project leader to offer the greatest potential for making assertions about the intensity or level program research experience with the kinds of impacts students reported. Assigning particular students from the cohorts to these groups was done in consultation with project staff.

Current Employment Titles:
38% of the respondents are currently employed with similar percentages for employment across the three subgroups. Job titles listed by students currently employed according to the three subgroups of program involvement (I, II, III) included:

associate

I. Intern
I. Youth Peer Eductor

Future Career/Job Intentions: When asked about the career(s) or job(s) CURE students intended to pursue, the variety of responses appeared to have some relationship to the intensity of their CURE experience. 81% of those with the most intensive research experience are interested in pursuing medical career compared to 50% of those in the academic course only and 28% of those who experienced the academic class and the 3-week summer research program.

Almost five times as many participants in Group I (CURE class only) were interested in pursuing business careers compared to participants who had CURE research experiences; and a greater percentage of students in Group I were also not sure about their future careers. Careers of most interest to all three groups included medical careers and research. The career of least interest to all groups was sales.

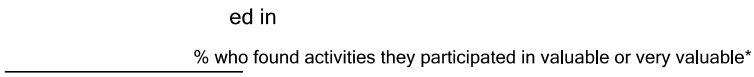
III. Academic Class + 3 wk CBST Research + Cancer Internship

Ideal Job/Career:

81% of the survey participants actually named their ideal job. Ten of thirteen students who named their ideal job and participated in the most intensive CURE research experience (Group III) named a medical-related job, with many having a specific focus (e.g. gastroenterologist, hematologist ncologist, OB/GYN). 100% of Group III who named their ideal careeer indicated some form of work dedicated to working with people/improving lives. Three of 16 who named their ideal career and participated in Group II named a medical career. None of those who named their ideal career and participated only in the academic course (Group I) named a medical-related career.

Value of CURE Activities:

Students were asked to rate the value of particular CURE program activities to them. If a student did not participate in an activity, they responded "not applicable". Overall, students rated the experiences they did have as either valuable or very valuable (4 or 5 on a scale of 1-5). Research experiences (internships and the 3-week summer guided research project) were rated highest. Those with more intensive research experiences rated the in-class academic school year of lower value than those without the more intensive experience.



Challenges presented by CURE:

In general, students who only participated in the academic class program experienced more significant and varied challenges than those who had a more extensive research experience. Not surprisingly, those with the most intensive research experience rated not being interested in the activities much lower than those with only the classroom experience - 6% of those who participated in the summer and internship experiences rated being not interested as a challenge compared to 40% of the students who only participated in the academic year class. Additionally, those that did not have the research-based experiences rated communications with CURE instructors as a significant challenge.

The top three challenges for all three groups of participants were: (1) the CURE high school teacher(s) communication with the student; (2) feeling intimidated by the laboratory or university environment, and (3) working and collaborating with other students. For those students who only experienced the academic year program, the classroom teacher presented the most significant challenge. No survey participants rated job conflicts as a challenge, and other challenges rated by all three groups, as very low were family obligations and difficulty with the program content. Only five respondents listed other challenges. These other kinds of challenges included:

Sometimes the actions we performed in the laboratory failed to teach me what the importance of the procedure was and how I may incorporate the lab work in the future.

The pace was slow at times. I became bored with the activity/ program every once in a while.

Only conflict that I had with CURE was when I got my first job I had to quit it, but other than that no real problems :)

Not enough field trips

There was not a clear structure.

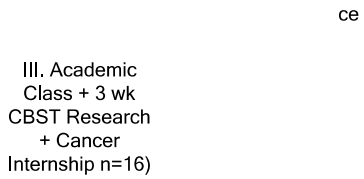
Influence of CURE program on college, job and career decisions

Students who had the most intensive CURE experience were significantly more influenced by the program in terms of their college, job and career decisions, with over half reporting that the experience had influenced them a lot or a great deal in each of these areas. Over half of all of the survey respondents (from all three groups) indicated CURE had influenced career decisions either a lot or a great deal.

III. Academic Class + 3 wk CBST Research + Cancer Internship (n=16)

When asked how the experience influenced these three areas (college, job, career), again, there was a significant difference in the ways in which the program made a difference depending on the level of involvement in research, with a higher level of influence experienced by students in Group III with the exception, interestingly, of CURE influencing interest in research positively by those students experiencing the Academic Program only.

How did your CURE experience influence your college, employment and/or career decisions? (check all that apply)



<u>Additional Comments about CURE's Influence:</u>

Some students offered additional comments about how CURE influenced them. These ideas resonate with what we learned from students who were interviewed

It had allowed me to have experience in learning about many medical careers as well as to experience working in the research fields. (Group III)

It influenced me to go into the cancer field. (Group III)

It led me to seek a university that can challenge me and prepare me for the future. / The personal attention that I got from my mentors led me to seek a school that can provide me with personal attention that can help me develop in the liberal science curriculum. (Group III)

The CURE Program really influenced me into choosing and exploring more into the science and medical field. I know that I want to go into a profession in the medical field, but the CURE Program made me want to explore the fields of science in depth. I really enjoyed the CURE Program and would recommend that it continues because it is an opportunity that really helps in college and career choices. (Group III)

They allowed me to meet people I wouldn't have met otherwise. They also helped me experience new environments. (Group III)

They help me decide what I really want to do and it is worth it. (Group III)

CURE has convinced me to go into STEM-based education; I am planning on doing Mechanical Engineering. (Group II)

CURE helped me better prepare for college by showing me the level of academic difficulty I was going to be facing. It also gave me wonderful mentors to talk to, especially Michelle, who boosted my confidence and helped me realize that although college may be difficult, I am very smart and need to just stick with and great things will come. (Group II)

I think that it is a great opportunity for any student no matter what field you decide to go in, in the future. (Group II)

It helped my understand the field better, but had little influence in my educational decisions. (Group II)

I liked the environment I was exposed to. It gave me a sense of importance. (Group I)

The CURE program allowed me to broaden my view on what careers I am capable of pursuing in the future. (Group I)

Significant memories about participating in CURE:

Students were asked to share a significant memory or two about CURE and explain why it was significant. Responses represented substantial stories and comments, and fell out into several main categories of ideas:

- Exposure to real-world, professional environments
- Value of mentoring and supports
- Lessons about collaboration with peers
- First-hand learning about science research
- What it means to do meaningful work

Here are some selected quotes from their open-ended survey responses[2] organized around these main ideas:

Exposure to real-world, professional environments

The field trip to the UC Davis medical center was the most significant to me because I was able to see first hand how a surgeon operates and the countless hours they must dedicate themselves to in order to become good at what they do. It also showed me the greater uses of technology in the medical field through evasive surgeries and dummies that actual simulate human tissue and breathing functions and such.

When I did CURE my first year I enjoyed the research during the summer I felt like I was in a college environment, but also felt like I was actually working. My whole second year in CURE was great because we had a smaller group, which allowed us to do more. During the fall quarter we did variety of experiments that exposed us to variety of scientific techniques and careers. Our winter and spring quarter we were research assists. I was even allowed to help out a graduate student with her research project one day when our mentor was not at the office. Toward the end of

[2] Some quotes have been lightly edited. The content has not been altered.

our spring quarter, we had to present to a groups of college and high students, teachers and researchers. Overall our second year was the best I enjoyed ever moment of it

One of my fond memories of CURE was working with doctors and mentors who love to help and teach the students. I had a lot of fun learning and very thankful for everything that I received from the CURE program. I learned how to take things seriously while working with experienced adults. It was one of the times where I felt like " wow, this is real life.

I look back on my experience as positive. It was my first opportunity working at a lab and it was a great opportunity. While I am no longer interested in that field, it was an excellent way for me to be in a professional environment. I also enjoyed working with the teachers at CURE. They helped me learn a great deal. I loved my time as a CURE Intern.

Support, challenge and guidance of the CURE mentors and teachers

The work we performed during my second year provided me with a great deal of laboratory knowledge that gave me upper hand advantage in some of my science classes once I entered college. / The mentors that the cure program invited which influenced me to pursue education outside of my comfort zone to seek an education in the private sections, and far from home thus allowing me to challenge myself.

After the presentations during my first year of the CURE program I got to talk to Marco and other doctors participating in the program. This meant a lot to me because I got to pick their brains about college and life in general. It was very beneficial to my ideas about college. Another memory I have is from my second year of the program where I got to present the work I performed in a U.C. Davis Cancer Research Lab. I was allowed to interact with students my age and younger and benefit from their thoughts about college and life goals. I enjoyed sharing my knowledge and receiving some ideas from them.

After my final internship and presentation my mentor, his best friend and a few of the other doctors took me out for a special lunch. They gave me their personal information and gifts. They really took me under their "wing".

Just talking with Michelle and learning about her organic chem background and how she got through college was very comforting. She was always such a joy to be around and really took the time to go over things with me until I fully understood the concepts. Working with such smart and amazing people was a little intimidating at first, but everyone was so nice and by the end I could not wait to get to the lab and class every day just so I could talk with them and soak up all of the wisdom and advice they had to offer.

The five-week internship in the lab at the CURE center was the most significant memory for me. Before then, I was not too impressed with the class because it seemed to move slow in the classroom or filled with busy work. However, once we came to the lab, everything picked up and everything was really hands-on. / Working with Michelle McCombs, I was able to learn how to work in a lab environment with that of a mentor assisting me along they way with my project. She was the most significant memory for me at the CURE center as I learned so much from her from learning how to work with stock solutions to running repeating experiments to avoid skewed results.

Collaboration with peers

Having a chance to create and work on our own projects with other group members. I took note of this experience because it taught me many things about working with other students (for example working with friends is not always ideal and communication is key to working together successfully).

A significant memory is the summer program because it allowed me to work along side my partner. It required us to use our own ideas along with the resources involved. I have to admit it was very challenging for me because I couldn't come up with very good ideas. But the hard work paid off. The end result was better than I thought it would be.

Learning about Science and Research first-hand

Chatting with mentors, working in research lab 3, learning about light, how cancer is being test and what genes like tumor suppressor gene (p-35) effect tumor/ cancer emerging, being able to visit people in the medical/research field, and how we designed our research topic.

My favorite internship was when I worked at the cancer lab. After I interned there I decided I might also like to pursue research as well as medicine.]

While working at the laboratory, Dr. Ruth Vanill let me go to the hospital to see prostate cancer biopsy. This helped me greatly by letting me see how and where the cancer cells comes from. It inspired me to want to work patient via doctor. It helped me see how cancer really affects people.

The most significant memory I have about CURE is going to the CBST building and doing the different science projects. I was able to get used to working with equipment in the lab that is more advanced than what I have used in college so far. It really solidified my love for science.

Meaningful and hard work, persistence, ownership and pride

A memory I will always have will working at CURE, was when my partner Dennis and I had to present our final project. I felt so proud that we had created an actual experiment that could be used to change lives. Also getting asked difficult questions that we were able to answer. Another very special moment was when we actually won 1st place, I felt so accomplished like," wow I actually did it!"

A significant memory would be my involvement in the national science fair. This allowed me to further express what I had accomplished in CURE, and share my new found knowledge with other researchers, professors, and community members.

Another memory I have is from my second year of the program where I got to present the work I performed in a U.C. Davis Cancer Research Lab. I was allowed to interact with students my age and older and benefit from their thoughts about college and life goals. I enjoyed sharing my knowledge and receiving some ideas from them.

The research aspect of the program was my most memorable event. It was significant because we all had to work so hard for three weeks, and at the end lots of professional people had came by to judge our poster boards. It was great to impress the professionals with our work.

Suggestions for CURE and similar programs

Most students responded to the question asking for suggestions or recommendations for this and similar programs. Again, we present these results according to the category of participation (III, II, and I, in order from most research intensive to less research intensive):

Do you have any suggestions or recommendations for how this kind of program for high school students could be improved?

III. Have a more structured class with a more invested and dedicated teacher.

terest.

II. I think that it would be a great idea if there was a workshop showcasing which colleges are best for science and medical majors. Also, it would include helpful tips on successfully getting into those colleges and making sure students are prepared for the workload.

teaching the material.

III. Key Findings from Student Interviews

Fifteen students were invited to participate in a structured phone interview (for Interview Protocol, see appendix C). All students interviewed had indicated in their online survey response that they would be willing to be interviewed. Students were selected based on a relatively even distribution across the cohorts and with input from the Project leadership.

This section presents key themes that emerged from analyzing the interview data that was gathered and organized into a common document on SurveyMonkey. Three researchers who completed the interviews studied the data set, debriefed the results and generated a set of recurring ideas or themes that emerged from in the data set. For each theme we provide a short description followed by examples from the interview data.

THEME - INFLUENCE

The CURE program influenced students' thinking about science/medical career options by helping them clarify what was important to them and what going into this particular field would require.

> *It has helped me really know that I want to go into the medical field, and that it is not easy and it takes teamwork and communication.*
>
> *I've always been interested in science but Cure helped me with my background in science and helping me get an idea of what I was interested in.*
>
> *It proved to me that science was my interest and in a way it has led to my major in biology and in science.*
>
> *CURE opened my eyes on what I was interested in and what I wasn't interested. With my project I learned that I wanted to make things - so I chose engineering. But I found out I don't like the software side of things because programming is really dull, because I enjoy working with my hands.*
>
> *Since I did my internships, I knew that I really wanted to be in the science field.*
>
> *CURE definitely encouraged me to follow what I wanted to do in the beginning, because I wanted to do science and the CURE program showed me the pros and cons of going into science, but there were many options, there wasn't just one thing you could do.*
>
> *It has helped influence me to pursue a career in math or science. It just seems there are so many questions that can be asked and there are so many answers that we don't know. Also, there is always something good, new and innovative that is always going to happen there and it really struck my curiosity."*

In some cases the project helped them decide that science and/or research was NOT what they want to pursue. We selected one student's response to represent this:

The biggest thing for me was being able to cross it off my list as something I knew I just did not want to do. It was good…before CURE I was going to college and going to study microbiology and do some kind of research. This was the only real research (I had experienced) and it showed me that it wasn't anything I was really interested in.

One student talked about the influence the field trips had on wanting to pursue research:

During the trips we went on to UC Davis we got to meet people and learn about cancer. It made me really want to go into the research field. It was much better than reading out of a book. We got to check out all of the equipment. I probably wouldn't have considered being in the research field without it.

THEME - EXPOSURE

Students experienced a variety of authentic research environments through which they learned about what it means to do research and about the nature and culture of science.

Before that I didn't know what it was to do research (methods, results, graphs). That has really helped me in college, along with doing a power point presentation. … also working well in a group and behaving professionally.

During my second year (in the first year we were learning the basics and reading/writing a lot) we only had 7 students and we were able to learn the techniques of a real scientists. The sense that it's there and I can do research on my own and work with scientists.

It taught me a lot about research and what I have to do if I ever want to do my own research. Going in depth and explaining it to others so that you can get funding. Showing the details and evidence so that you are showing results. I learned a lot about cancer and how it's an out of control cell division.

I know people who feel that they want to be in research, they haven't actually experienced it. I feel like I know and I got an idea of how it is going to be, because other students don't know that there is a lot of down time and there is a lot of patience and I feel now that I know that and I want to be a part of that.

I can say that I've done research before and it helped me to see the variety of the scientific areas. I learned things that you normally would learn in college. It opened my mind to what is out there.

I just know what it means in a research lab that there is a lot of repetition involved and you may have an idea and you execute it, but the actual execution could take like years on end to perfect because you have to put out so many results of the same thing.

THEME - THE CURE ADVANTAGE

In some cases students discussed a specific advantage CURE has given them.

We were shown a lot of the UC Davis med center and we got tours of lots of the places. It is an advantage to be exposed to those places. The advantage that I have is experience with research and being able to present in front of other people.

I always enjoy science but it showed me the variety of careers I could take if I chose to study science. Working with real scientists was really nice and gave me a chance to work in a real work environment. I am still interested in doing research. I'd like to study environmental issues.

It gave me an upper hand in learning things like lab work. When I took my chemistry class learning how to work in a lab helped me with that.

On my resume I referenced the CURE program and that has gotten me a scholarship it was a joint scholarship by Intel and NSF - one time $5k scholarship.

THEME - COLLABORATION AND TEAMWORK

Students talked about the challenges and learning that happened as they worked in teams to collaborate on their projects.

I realized that there are some people that I couldn't work with. You can't have a group with two leaders. I tried my best to work as a team. I had to learn to work with people. I prefer to work on my own but I know that I'm going to have to work in a team in the future.

I led a lot of our team projects even though I'm not much of a team leader usually. It helped with my leadership skills. It was kind of scary being the leader of a group. I'm not much of a people person.

I worked with a bunch of people and I learned patience and how to communicate efficiently.

We picked our own groups and got to work together … sometimes working with your friends isn't the best idea.

I'm mainly and independent worker and we had to work in groups and I learned that other people's ideas can really help and contribute greatly.

I learned that sometimes if you're working with a group, sometimes people may have a really big ego and it's best to let them lead a small bit... I learned to work in a team and I found it really useful for certain situations, like yesterday I was replacing a part on my car. It would have been really hard to do by myself…

I didn't really like working in a group. I didn't take the initiative, but then after CURE, I learned that working in groups was good and it helped me stop being shy."

We worked in groups and we had no idea and we really just hoped to formulate and get a project going. We really had to think out of the box and think more creatively, especially when we ran into problems.

THEME – PERSISTENCE

Students talked about the persistence they needed to figure things out– and the value of the guidance from staff - to achieve their goals. The work was often hard, tedious and undefined – yet guided. It took persistence and support to see it through.

Once I worked in a group and we were having tech difficulties and I stepped in and said we had to continue because "science isn't something you just quit when you hit an obstacle".

It was hard at first. They (CURE staff) worked with us, but they wouldn't tell us what we should do. They would talk with us and then at the end of the conversation you'd have your own idea with out them telling you.

I really had to learn to stick with things. The summer program taught me to try hard and not to give up. I tried not to procrastinate (even though I did).

Learning the material was really hard. Our mentor was trying to teach us the biology, etc. and it was really hard. Getting down to understanding and explaining the material was hard but being able to do it was the fun part.

I stick with it because there is always something you can learn from it, even if it is not the funnest thing in the world. For example this year I had a different lab experience [internship] and it was a lot more interesting working with a chemist. Now you are seeing what a chemistry major can give you. It just shows you more opportunities, or more choices that you can make.

We won first place! We had a lot of trouble in the beginning getting started, so having it all come together and doing our presentation, winning really helped.

THEME - LEARNING 21ST CENTURY SKILLS[3]

Students also were asked about their sense of other related 21st Century skills and knowledge they gained through the project. These include things like leadership, use of technologies, critical thinking skills, etc.

I learned how to be a leader in CURE. I had to encourage my partner to do the work he needed to do and when I did the summer program I had to be the leader but also step back and listen to others.

[3] For more on The Partnership for 21st Century Workforce Skills, see their website at http://www.p21.org.

Before (CURE) I didn't know much about lab equipment but I learned a lot in the program and it helped me a lot when I got to college.

It provided me with knowledge on lab equipment, working in groups, careers that are available and helping me know that science is something I want to be involved with.

When we were in the research lab and in class, when our teacher was lecturing us about the study of light and its use in the fields of study. I learned how light can be changed, like through a prism and then she told us how to make a spectroscope. When we finished it, not every single spectroscope was the same. So we had to adjust. . You had to like think what you want, change things so you will get the results you want."

The way I encounter real world situations, I approach them differently now. So before CURE I opened up a video game system, I did not keep track of anything and broke it many times... but with the skills I learned with CURE like taking notes and recording everything, I'm able to take apart computers, video game systems and cars....to keep record, I normally just take pictures, if something has a bunch of bolts of it... the holes are the same size... but bolt heads are different shapes and sizes. I have also used a voice recorder when I take some thing apart... that helps...

I think it definitely helped me through some processes… it helped me be a more logical person and just trying things out more.

There were so many different technologies that I had never even [seen], everyone looked really scared, but [they] definitely brought it down to a level that I felt everyone in the class could really understand and feel confident using. [For example], pipetting and using the hood station where you are using UV light. I still remember looking at it and thinking, how am I supposed to use this? By the end I felt really comfortable.

There were many tools that weren't normally available to us to use and the use of technology was greater. For example, for my experiment I had to use plastic containers to calculate the oxygen and CO2 and they were being put on these plants and so that they could calculate all 3 of the factors that I wanted to calculate and put it on graphs. So it really taught me how to work with different types of computers and any electronics to help me to do scientific research.

CURE *taught me how to take a big idea and make it very specific instead of just oh, I want us to research cancer- what type of cancer and what effect does the cancer have on the body and why do you want to use this or why do you want to do that and so really narrow it down, pick what you want to look at, and how it affects it…. It helped me make better hypothesis and better questions and so I could execute a better experiment*

THEME – KNOWLEDGE ABOUT CANCER IN RELATION TO THEIR LIVES

Some students were clear about what they'd learned about cancer science and how that knowledge has influenced their own lives and lifestyles:

> *I'm more comfortable now with science and speaking with other people about what I know especially when I learned about cancer and what it does to people. Now I can share the information with my family about my dad's prostate cancer and my brother's cancer.*

> *First did not know that light could be used to treat cancer. I learned that lasers were used a lot and you could move things with lasers and cut out what was cancerous. Another thing I found out that was interesting... not all cancer is the same. You have different kinds of cancers for different parts of the body part and different kinds cancer within each part of the body. … I learned that the scientific method is applied to just about everything in research. If it's not something that's repetitive it's not science. Let's say somebody makes a machine but that machine only works once and no one is able to replicate again... that could be considered a fluke and no body is able to make it. It's not really science because you didn't record your data!*

> *I learned a lot about eating healthier and how to stay away from actually getting cancer longer. Eventually it will hit most people, but there are certain things that you can do to extend the time you're free of it. Hey cancer is a mutation and DNA is always mutating, changing evolving, so it'll happen eventually.*

IV. Summary: Student Vignettes

We selected three students whose stories represent many of the themes and concepts that emerged from the survey and interviews and have represented them here in abbreviated vignettes. Because of the anonymity promised, we have assigned pseudonyms and removed associated years of participation.

Tony *is currently interested in pursuing public health, currently working in a lab, and learned much about collaboration through CURE.*

Tony is currently attending a small liberal arts college in the northeast, and works in a research lab on campus. He hopes to pursue a business degree in graduate school and possibly work in public health. He has always enjoyed science, and says that participating in CURE provided a peek into a world he was interested in, and that it, *"helped with my background of science- being able to do more labs and different types of labs and meeting different types of doctors and people that work in the health industry and getting a feel for what I really enjoy doing."*

A key memory from CURE that stands out for this Tony, *"the fact that we got to run our own project for about a month and we came up with the topic and we were able to figure out what we wanted to do and we picked our own groups…just being able to work in groups and see that sometimes working with your friends isn't the best idea."* The second project he did with CURE was valuable to him because*, "I didn't know too much about skin cancer before running the project and so I was able to learn about teen cancer and I was able to learn about the age groups it primarily affected."* In addition, the program helped him because, *"I was able to learn multiple things about myself and most importantly about group work and just being able to have experiences that I probably would not have had. I wouldn't have been in the UC Davis Hospital meeting patients and talking to them and seeing how they were doing… and learning about radiology from someone taking time out of their life and busy schedule."*

CURE had many influences Tony, primarily improving his ability to work with others. "I didn't think you would work with others as much in college… but group work is actually very key for labs and things like that so being able to do it is crucial."

Alicia *decided to pursue a medical field because of CURE and learned much from the exposure and experiences related to the authentic real-life experiences of being a scientist and working in a lab. She also gained communication and organizational skills and hopes to be an Ob-Gyn in the future.*

Alicia is currently a senior in high school, and plans to attend college next fall to major in biology. Her goal is to become an Ob-Gyn. She says, "CURE helped me know, really know, that I want to go into a medical field and that it takes a lot of hard work, teamwork and communication with other people."

The most memorable part of CURE for this student was, "being able to work under the hood with the cancer cells and doing hands-on techniques that they do to work on curing cancer… it was fun." Talking with the doctors gave her valuable insight into the profession. It also made her realize how hard she would have to work to achieve her dream of becoming an Ob-Gyn. The most challenging thing was the trial and error involved with the research, "putting your all into one thing and it doesn't work and you have to start all over again was the most challenging."

The program helped her academically to focus more on her work and to be more assertive and to seek help when necessary, "to get help from people who have been there and people who can possibly help me later in life as well." She improved her ability to work with others and to stay on track so she wouldn't let down someone who was relying on her. She also learned how to make her power point presentations more engaging by creating better slides and making them interesting to in order to "keep people paying attention to what we have to offer."

She also gained leadership skills. "When my partner was confused about something I would take the initiative and help her out and get her back on track and she would do the same for me."

It meant a lot to this student to see first hand how the people involved in the CURE project were dedicated to helping young people like her.

Lee *is interested in international development and public policy, but fell in love with doing research through CURE and plans to pursue these fields through research.*

Lee participated in CURE for two years and is currently a sophomore at UCLA. He spends his summers volunteering at the local farmer's market. He is interested in community issues and has been researching public policies. He entered college thinking he would study biochemistry and become a marine biologist, but has turned his attention to international development as well as public policy. He also plans to continue doing research on his own because "*I like to do my own research when I study things*". An important impact of CURE for this

student was learning that he has to think about the details of explaining his research so that other people can understand it and be able to "*prove to people that it is very important*." It was eye-opening for him to see how much work is involved in getting research grants.

This student says he was influenced by CURE in many ways. He says one way was that *"it showed me the variety of careers I could take if I chose a career in science… I like the variety of techniques we learned through western blotting and extracting DNA and working with real scientists was pretty amazing… It is nice to have the chance to work in an environment where you are under pressure and really see how the work environment really is."* CURE also expanded the way he views science from something relatively "simple" as a career like biology or chemistry to a much greater understanding of the wide variety of science careers available. CURE improved his self-confidence by forcing him to present his project, making it engaging to the audience, being prepared, and talking to people more knowledgeable and experienced. *"It helped improve my speaking skills as well as encouraging me not to be afraid of giving presentations and how to get people's attention and how to answer questions."*

CURE influenced him to initially decide to study biochemistry but once he realized that he can do research outside of his major he felt free to pursue international development and public policy. He enjoys sharing ideas with others and getting everyone's input on an issue or problem. He feels he has benefitted greatly from participating in the CURE program.

Concluding Comments

The CURE program offered through CBST at the University of California, Davis influenced and/or impacted high school student participants in many ways including (but not limited to): enabling students to evaluate in much more specific terms the attributes of a career in scientific research that appealed (or didn't appeal) to them; gaining communication and leadership skills; learning to use technologies associated with the biomedical fields; understanding the challenges and requisite skills necessary for collaborative work; and appreciation of the degree of dedication cancer research/medical career paths entail.

The deepest impacts or influences that showed up in the data were associated with the most intensive research experiences in the program – those students who fell into the "Group III" category. Interestingly, that group also found the program's challenges to be less of a barrier to their learning and interests in pursuing (cancer) research science.

Exposure to the real worlds, work, expectations and demands of scientific research through field trips, guided research projects, and/or actual internships in a lab at the medical center/university were the most influential attributes of the project. The high school classroom component of the program was less connected to an

impactful or influential experience. Fewer students reported that the high school classroom component was a major influence on their thinking about careers/college trajectories, though students did acknowledge the importance and value of a classroom teacher who was knowledgeable and also a good mentor.

Though a stronger interest in pursuing a medical and/or research oriented career existed for those students who had the most intensive research experiences through the CURE Program, we were impressed that for almost all student participants in this study, we saw a strong interest in and drive toward pursuing educational and career trajectories that contributed to human-kind in one way, shape or form.

The complete experience of the CURE Program (including all opportunities for research) seemed to help students gain understandings, skills, inspiration, and in some cases an advantage toward becoming more focused and intentional about their educational and career goals, most of which were STEM-related. Should a CURE program funding opportunity arise again for High School Students, the value-added of designing an authentic research components into every students' program experience would be worth the the investment, because we believe that program component had the most profound impact on students.

V. Appendices

A. Online Survey Instrument
B. Survey Results Workbook
C. Student Interview Protocol