

Academic Enrichment through Capstone Executive Summary

Lakeland Community College requests \$30,000 to fund *Academic Enrichment through Capstone*, a project that addresses the Martha Holden Jennings category of improving learning in science. This project will leverage a grant that Lakeland Community College (Lakeland) and John Carroll University (JCU) received from the Ohio Board of Regents this year to fund a Regents Science Academy.

The goal of the Regents Science Academy is to excite and prepare fifty 11th and 12th grade high school students to pursue college-level science, with an emphasis on encouraging students to pursue secondary teaching in this field. Lakeland will recruit students from Lake, Geauga, Ashtabula, and Cuyahoga counties. Recruitment activities will focus on students with an average GPA, 2.5 and above, as well as females and minorities who are significantly under-represented in STEM education and careers.

During the academy's three-week intensive summer experience, students will earn dual college / high school credit by taking *Everyday Chemistry*. This popular course will enable students to develop and apply chemical concepts to show the importance and relevance of chemistry in our daily lives. The Academy is also designed to provide an intensive experience, immersing students in College culture; Students will be on Lakeland's campus for 120 hours during the Summer Academy and will also spend two days at JCU, including an overnight stay in the dormitories.

All fifty students who participate in the Summer Academy will take the eight month Capstone course, which will enrich students' academic experience and provide two additional units of college credits. Capstone is an innovative education method that enables students to integrate previously learned concepts into broader theories and to build upon knowledge through research, interviews, field work and inquiry-based learning experiences. Capstone requires students to work independently and in teams, enabling students to master learning skills needed to be successful in college. Additionally, students will be able to integrate critical thinking and inquiry-based learning skills acquired during the Summer Science Academy to their capstone course. Students will select one of five Science themes - *Biology, Biotechnology, Environmental Science, Geology or Astronomy* – as their Capstone project.

Five secondary teachers will serve as Capstone Advisors, providing guidance and oversight to students throughout the school year. In turn, Lakeland Science Faculty will mentor Capstone Advisors and oversee their work. Additionally, ten students from John Carroll University's Education Department will serve as Capstone mentors, assisting the Advisor and students throughout the year. The Capstone mentors will not only assist students, but serve as role models encouraging students to pursue teaching as a field of study.

Students – *and Advisors and Mentors* - will begin learning about, and planning for, their Capstone course during the Summer Academy. Lakeland will provide students with guidelines for their Capstone, including monthly benchmarks, to facilitate their work and success. Coursework will begin in September, 2007 and conclude in April, 2008. Students may work independently to conduct research and also meet periodically with their teammates, Advisor, and Mentors to conduct fieldwork and discuss project findings and progress. In April, all students, advisors, and mentors will gather and students will present their Capstone projects to the Science Academy Advisory Council during a competition. Lakeland will invite parents, school principals and teachers to the competition to recognize student achievement.

Academic Enrichment through Capstone

Purpose & Background

Purpose. Lakeland Community College, in partnership with John Carroll University, is requesting a \$30,000 grant from the Martha Holden Jennings Foundation to provide high school students academic enrichment through a Science capstone course. The specific purpose of this grant is to improve 11th and 12th grade high school student achievement and participation in Science by developing and offering an eight month Capstone Course. Capstone is an innovative education method that enables students to integrate previously learned concepts into broader theories and to build upon knowledge through research, interviews, field work and inquiry-based learning experiences. Lakeland Community College (Lakeland) will partner with John Carroll University and area high school teachers to implement this innovative project. The Capstone course will build-upon an intensive, three week Science Academy which students will complete prior to their Capstone course (the Science Academy is described below).

Background. Lakeland first opened for classes in 1967 with an enrollment of 1,073. Based on Fall Semester, 2006, total enrollment has grown to 8,500 students. Serving residents from the counties of Lake, Cuyahoga, Ashtabula, and Geauga, Lakeland's mission is to provide quality learning opportunities to meet the social and economic needs of the community.

In January, 2007, the Ohio Board of Regents awarded Lakeland a \$340,000 grant to implement a Regents Science Academy for 11th and 12th grade students. The goal of this project is to excite and prepare fifty high school students to pursue college-level science, with an emphasis on encouraging students to pursue secondary teaching in this field. A grant from the Martha Holden Jennings Foundation will enable Lakeland and its partners to enrich the Science Academy with a Capstone course spread through the academic year.

Regents Science Academy. A diagram of the Regents Science Academy is included as Appendix 1. The Regents Science Academy has four objectives:

- 1) Offer dual college/ high school credit courses;
- 2) Enrich the Summer Science Academy with a hands-on, project-based Capstone course spread throughout the academic year;
- 3) Immerse high school students in college culture, increase aspiration to attend college, and provide academic and career advising;
- 4) Engage secondary teachers and College faculty in activities and dialogue to improve science pedagogy.

Lakeland will recruit fifty students from Lake, Geauga, Ashtabula, and Cuyahoga counties. Recruitment activities will focus on students with an average GPA, 2.5 and above, as well as females and minorities who are significantly under-represented in STEM education and careers. Lakeland will partner with area school districts to recruit students who are considered academically average (2.5 GPA), as well as minority and female students who are typically under-represented in STEM fields. During the academy's three-week intensive summer experience, students will earn dual college / high school credit by taking *Everyday Chemistry*. This popular course will enable students to develop and apply chemical concepts to show the

importance and relevance of chemistry in our daily lives. The course design is interesting and enjoyable and reduces students' anxiety of taking Chemistry. Areas of focus include scientific method of inquiry, atomic and molecular structure, phases of matter, chemical and physical changes, acids and bases, and polymers. Prior to the Summer Academy, Lakeland faculty and secondary teachers will review the curriculum and identify innovative strategies to reduce formal lecture time and increase opportunities for students to conduct hands-on lab experiments. Additionally, Lakeland recognizes that participating students may not have a solid Math or Science foundation (no pre-requisites are required). To insure student success, Lakeland will examine the course and identify how to incorporate Math study and problem solving skills focusing on algebra and basic statistics

College Immersion. Lakeland's Summer Academy is also designed to provide an intensive experience, immersing students in College culture. Students will be on Lakeland's campus for 120 hours during the Summer Academy, using all campus facilities including the campus dining hall, athletic facilities, classrooms and labs. Workshops, guest lectures and tours are intended to increase familiarity to college life. Students will also spend two days at JCU, including an overnight stay in the dormitories. Lake/Geauga Education Assistance Foundation (LEAF) will present workshops on College applications, financial aid and scholarships and familiarize students with college prep services such as ACT and SAT tutorials and classes. Throughout the year, LEAF will update students on college prep activities, such as College fairs and FAFSA orientations. Students will also meet with academic and career advisors who will provide information on careers in STEM, including Science teaching.

Improving Science Pedagogy. Another goal of the Summer Academy is to improve secondary teacher science pedagogy. Fifteen area secondary school teachers will participate in the Summer Academy and Capstone activities, with a focus on integrating improved pedagogic concepts into the classroom. Teachers will participate in numerous ways: 1) Assist Lakeland faculty in revising and innovating CHEM 1050; 2) Audit *Everyday Chemistry*; 3) Act as Lab Instructors and co-present components of CHEM 1050; 4) Serve as Capstone Advisors; 5) Participate in three half-day symposiums designed to improve pedagogy; and 6) Participate in on-going dialogue with Lakeland and JCU faculty to improve Science pedagogy. Secondary teachers will audit *Everyday Chemistry*, enabling them to learn effective pedagogical tools and concepts as they become the "student."

By auditing and participating in these classes and Symposiums, science teachers will acquire new skills and techniques that will create fundamental pedagogical changes in the classroom to improve student learning. Additionally, Capstone Advisors will learn valuable tools in integrated and applied learning and have the opportunity to use these skills in their classroom. Creating a framework for on-going dialogue between secondary teachers and College faculty will encourage the flow of innovative ideas in teaching Science. Secondary teachers will receive a \$1,000 for teaching and participating in the Summer Academy. Capstone Advisors will receive a \$5,000 for teaching and participating in the summer academy and for teaching the Capstone course during the academic year.

Technology that supports Student Learning. During the Summer Academy and throughout the year, students will use technology to support their learning and communication with peers and teachers. In *Everyday Chemistry* and in other Science Academy modules, students

will use a wide range of sophisticated lab, computer and video equipment. Students will also have the opportunity to use extensive bioscience equipment purchased through a Department of Labor Biotech grant. Through their Capstone experience, students will be able to access a wealth of technology available at partnering organizations, such as Cleveland State University's Starlab.

Students will also use a web-based resource, **VOCE**. JCU will facilitate the use of VOCE as an **online learning community** in the Blackboard environment. VOCE is being developed as an online classroom with people, resources, and tools specifically designed to foster student/teacher and institutional collaboration for effective teaching and learning. VOCE will enable substantive dialogue that engenders sustainable change in instructional practices. VOCE's will have five virtual spaces that support teaching in an innovative way: 1) a *Forum* for live discussions and workshops; 2) a *Conference Center* for multimedia including pod casts; 3) a *Lab Bench* with software tools and networking capability to support data analysis and interpretation; 4) a *Lesson Design Studio* for teacher collaboration and assistance in designing standards-based lessons and new approaches; and 5) a *Round Table* where faculty and teachers can engage in lesson study and examine student work to guide instruction. Students, Advisors, Mentors, and Lakeland faculty will access a basic version of VOCE during their Capstone for live discussions, pod casts, and analytical software for data analysis. Students will also use VOCE to create electronic portfolios of their Capstone work (Appendix.2).

The Need

The need for this project is two-fold. First, there is a significant and growing need to better prepare and excite high school students to take Science in College. In the United States, the number of 18 to 24-year olds who receive science degrees has fallen to 17th in the world, whereas it ranked third three decades ago. The US share of patents has fallen from 60% to 52% since 1980; the percentage of scientific papers written by Americans has fallen 10% since 1992, and the percentage of American papers published by the top physics journal, Physical Review, has fallen from 61% to 29% since 1983.¹ In the midst of these alarming statistics, America's competitive edge in the global marketplace continues to shrink. To improve our position and to protect our national security, we must reverse this trend and increase Science graduates and Science teachers.

Second, there is a need to offer programs that target students who are "average" learners. Currently, the majority of enrichment programs are directed toward academically gifted students. Lakeland will partner with area school districts to recruit students who are considered academically average (2.5 GPA), as well as minority and female students who are typically under-represented in STEM fields. In many cases, the "average" student often lacks the opportunity or incentive to participate in programs that will academically prepare them for a college STEM career. Many of these students also lack the aspiration, preparation, and information needed to pursue these careers. Moreover, many of the students who excel academically have already selected academic careers while many underserved students have not; by targeting the "average" student, we will increase the absolute number of students who pursue Science in College.

¹ "Science and Engineering Indicators 2004," National Science Foundation / National Science Board, May 4, 2004.

Action Plan

After students complete the three-week summer academy, it is critical that they continue to be engaged throughout the year so that they are fully prepared to pursue college-level science, with a focus on secondary teaching in this field. On-going science activities will also enable students to incorporate learning from their Summer Academy experience. Capstone will provide this experience.

Capstone. All fifty students who enrolled the Summer Academy will participate in an eight month capstone course, receiving an additional two units of college credit for independent study.² Capstone is an innovative education method that enables students to integrate concepts previously learned into broader theories and to build upon that knowledge as they explore a hypothesis through research, interviews, field work and inquiry-based learning. Capstone requires students to work independently and in teams, enabling students to master learning skills needed to be successful in college. Additionally, students will be able to integrate critical thinking and inquiry-based learning skills acquired during the Summer Science Academy to their capstone course. Students will select one of five Science themes *Biology, Biotechnology, Environmental Science, Geology or Astronomy* – as their Capstone project. Capstone partner organizations, listed in Appendix 3, offer student site visits, field work and the use of facilities to support their projects. Additionally, many of partners offer internships, which may be available to students interested in additional experience.

Five secondary teachers will serve as Capstone Advisors, providing guidance and oversight to students throughout the school year. In turn, Lakeland Science Faculty will mentor Capstone Advisors and oversee their work. Additionally, ten students from John Carroll University's Education Department will serve as Capstone mentors, assisting the Advisor and students throughout the year. The Capstone mentors will not only assist students, but serve as role models encouraging students to pursue teaching as a field of study.

Students – *and Advisors and Mentors* - will begin learning about, and planning for, their Capstone course during the Summer Academy.

- **Week 1 of Summer Academy:** Students will learn about Capstone including its goals and activities;
- **Week 2 of Summer Academy:** Community partners and Lakeland faculty will provide examples of Capstone courses and activities;
- **Week 3 of Summer Academy:** Students will choose a theme, meet with teammates, advisors and mentors and design a Capstone thesis for their year project.

Lakeland will provide students with guidelines for their Capstone, including monthly benchmarks, to facilitate their work and success. Lakeland Science faculty will serve as partners and mentors to Capstone Advisors during the year. Coursework will begin in September, 2007 and conclude in April, 2008. Students may work independently to conduct research and also meet periodically with their teammates, Advisor, and Mentors to conduct fieldwork and discuss

² Student recruitment is outlined on page 1.

project findings and progress. Students, advisors, mentors, and Lakeland faculty partners will also use a basic version of JCU’s Virtual Outreach Classroom for Educators (VOCE) in Blackboard to interact (please see a description of VOCE below). In April, all students, advisors, and mentors will gather and students will present their Capstone projects to the Science Academy Advisory Council during a competition (the Advisory Council is described below). Lakeland will invite parents, school principals and teachers to the competition to recognize student achievement.

Collaboration. A central feature of this project is the collaboration with John Carroll University, area school districts (superintendents, principals and teachers), LEAF, Lake, Geauga, Ashtabula County Education Service Centers, Mayfield School District (Cuyahoga County), the Lakeland Tech Prep Consortium, and Capstone community partners. Collaborations are described throughout this proposal. To facilitate this collaboration, Lakeland will develop a **Science Academy Advisory Council** including representatives from organizations listed below. Members will meet quarterly and advise Lakeland on outreach and recruitment, Summer Academy and follow-up activities, secondary teacher pedagogy, program evaluation, funding opportunities, and sustainability.

Regents Science Academy	
Partner	Role
John Carroll University	Summer Academy student workshop on teaching as a profession Secondary Teacher Symposium on Science Pedagogy 10 JCU Education Majors serve as Capstone Mentors Facilitating the use of VOCE
Lake, Geauga, Ashtabula Education Service Centers, Mayfield School District (Cuyahoga County)	Coordination with School Superintendents and principals.
Regional School Districts	Science Teacher participation Student referral
LEAF	Workshops and information on College applications, financial aid, scholarships, ACT/SAT tutorials.
Lakeland Tech Prep Consortium	Student Referral
14 organizations listed in the Appendix 3	Capstone partners offering students a wide range of opportunities including field visits, use of equipment and internships.
Martha Holden Jennings	Funding to support innovation in science pedagogy

Outcomes

Students participating in the Capstone course will experience the following outcomes:

- Improved confidence in taking Science courses;
- Improved grade in Science courses taken during remainder of high school experience;
- Increase in number of Academy students who pursue a Science major in College;³
- Increase in number of students who pursue Science teaching as major in College.⁴

Project Evaluation

Metrics to Measure Academy Success. The Ohio Board of Regents will evaluate the overall success of the Summer Academy. Lakeland will evaluate the success of the Capstone course using qualitative and quantitative program evaluation methodologies. In partnership with the Science Academy Advisory Council, Lakeland will also continuously improve program activities to maximize success.

Metrics to measure success of the Capstone program and anticipated program outcomes listed above will include: 1) Number of students participating; 2) Retention rate in the Capstone course; 3) Grade Capstone; 4) Student survey examining interest in pursuing additional Science courses and Science teaching as a career; and 5) Student survey examining improved confidence in taking Science courses. Lakeland will also gather longitudinal data in these areas: 1) Number of students who pursue a Science major in College; and 2) Number of students who pursue Science teaching as major in College.

Program evaluation activities will be performed jointly by John Carroll University faculty and Lakeland faculty, with support from Lakeland's Department of Research and Planning. This partnership will not only support continuous program improvement through program evaluation, but it will also strengthen collaboration between a public and private educational institutions. Moreover, it will provide an opportunity for faculty to publish their findings and to examine more deeply the impact that academic enrichment has on student achievement.

³ Baseline will include only those students who participate in the Academy.

⁴ Again, baseline will include only those students who participate in the Academy.

