Case Study Report
Lehigh Carbon Community College
Science, Technology, Engineering and Mathematics (STEM)
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Introduction

The College and Career Transitions Initiative (CCTI) involves Lehigh Carbon Community College (LCCC) and secondary schools in the Carbon Lehigh Intermediate Unit 21 of Lehigh County and Carbon County, Pennsylvania. This CCTI initiative is focused on introducing "Academic Literacy in the Content Area" to science, technology and mathematics teachers. Specifically, this highly focused CCTI project seeks to improve "the reading skills of secondary students in the areas of science and technology and mathematics, with an ultimate goal of preparing students for postsecondary education and future employment in high-demand technological fields."

The lead postsecondary institution in this CCTI initiative is Lehigh Carbon Community College. Established in 1966, Lehigh Carbon Community College (LCCC) is a comprehensive community college with its main campus in Schnecksville, PA. The college has four off-campus sites offering degree programs including the new Morgan Center which opened in fall 2003, and many other locations offer programs throughout the college's service area. LCCC is accredited by the Middle States Association of Colleges and Secondary Schools.

The mission of LCCC is to respond to the community with high quality education through open access and affordability. In his message to the community in the Spring/Summer 2004 Credit Schedule, President Donald Snyder characterized the college's mission as steadfast in its commitment to quality and access when he wrote:

> *One aspect of LCCC remains unchanged--our mission, which defines our unwavering commitment to high-quality, affordable, and accessible education for our students and community.*

LCCC offers 15 transfer associate degree programs (A.A. and A.S.), 52 career associate degree programs (A.A.S.), 33 certificate programs, and 10 specialized credit diploma programs. In addition to credit programs, LCCC offers a variety of community education programs and courses, literacy and job training, adult basic education, continuing professional education, and specialized training for business and industry. Short-term job training programs have been offered for many years for disadvantaged populations, including unemployed, low income, minority, and individuals with disabilities. In 2001-2002, more than 7,300 students were enrolled in credit programs, and nearly 14,000 in noncredit registrations. Funding for LCCC is

appropriated by secondary schools in Lehigh, Carbon and Schuylkill Counties, and from federal, state, foundation, or corporate funding.

According to the Pennsylvania Commission on Community Colleges (see http://www.pacommunitycolleges.org/), the Community College Act of 1963 (Act 484, Statutes of 1963) authorized local communities to petition the Pennsylvania State Board of Education to sponsor and establish community colleges throughout the state. Each college was required to have a local sponsor: a city, a county, an individual school district or a consortium of school districts. Fourteen community colleges were developed under the Community College Act of 1963. Included among the fourteen was Lehigh Carbon Community College (LCCC), established in 1967. Four community colleges are sponsored by secondary school districts, one of these being LCCC; the remaining ten are sponsored by counties or municipalities. Specifically, all nine school districts in Lehigh County and four of the five school districts in Carbon sponsor LCCC. According to the Commission, transfer is a priority for community colleges in Pennsylvania with all community colleges in the state working to "develop relationships with four-year colleges and universities throughout Pennsylvania and the surrounding states that permit graduates to continue their education."

In the area of career-technical education (CTE), LCCC has been active in its acquisition of support for various programs and services in recent years. A primary grant led by LCCC is the Tech Prep Demonstration Grant awarded in FY 2001. This 3-year grant, totaling almost $575,000 is being used by LCCC and the Lehigh Career & Technical Institute (LCTI), a part-time secondary area vocational school, to "revise and implement a multi-track Tech Prep manufacturing technology program that will serve 60 secondary students" (see http://www.ed.gov/programs/techprepdemo/awards.html). Grant funds are being used for curriculum development, equipment, project management, and career counseling for students, with new curriculum offering robotics and semiconductor technology at the secondary level and biotechnology, optoelectronics, and welding at the postsecondary level. High school juniors and seniors have the opportunity to enroll in academic and technical courses at LCCC. Students who perform well on the college's academic placement exam and have a B average in their high school courses can receive college credit while other students are placed in remedial and developmental academic courses. Students can earn up to 15 college credits by participating in the program. Plus, all students have the option of participating in internships.

In sharing information about the Tech Prep Demonstration grant, Dr. David Fallinger, Director of the CCTI project, spoke with great pride about LCCC's "national reputation" in the area of CTE. He talked about LCCC's long history with tech prep, particularly the many articulation agreements that have developed over the years, and especially about LCCC's more recent identification as a national Tech Prep Demonstration Grant site. Other state and local awards were identified in various CTE areas as well. From the Commonwealth of Pennsylvania, LCCC has grants for an Advanced Manufacturing 2 + 2 + 2 Workforce Leadership Pipeline and for Nanofabrication Manufacturing Technology. The Pennsylvania Department of Community and Economic Development funds a Biotechnology Critical Job Training grant and an Optoelectronic Customized Job Training grant, plus the Center for Optical Technology Technologies (Lehigh Univiersity). From the federal government, LCCC has the Nanofabrication Manufacturing

Technology with Pennsylvania State University and Computer Science, Engineering and Mathematics Scholarship (CSMES) from the National Science Foundation (NSF) as well as Carl D. Perkins Career and Technology Education programs and services, including funding for Lehigh Valley Tech Prep with Lehigh Career and Technical Institute. Local industry-sponsored technology grants include the Digital Divide – Mahanoy City (Verizon), Project VITAL – Verizon Introduces Technology to Adult Learners (Verizon Foundation), Digital Divide – Allentown (Allentown School District, DBSi, TuWay Wireless, OmniE Labs, and The Affinity Group), and Chem Tech Futures Academy (Air Products and Chemicals).

The CCTI Partners

The public secondary schools in Carbon and Lehigh Counties are targeted for the CCTI project through a collaboration with the Carbon Lehigh Intermediate Unit 21, a state and locally supported educational service coordination and provider agency. This two county Intermediate Unit Region is made up of 14 public school districts with 15 high schools and 2 area vocational technical schools, serving a population of 353,000 and embracing 375 square miles. The student population in the 14 school districts in 2002-03 school was 53,330; the technical schools served another 2,100. In the first year of the grant, three high schools committed to participate in CCTI, and these schools are Northwestern Lehigh High School, Southern Lehigh High School, and Whitehall High School. More high schools are expected to join the CCTI project in 2004-05 and subsequent years.

The CCTI is viewed as highly complimentary but not duplicative of the Lehigh County Career Pathways Project that emerged a few years prior to 2003. The project has involved the region's public school systems and the Lehigh County Career and Technical Institute. "Career Pathways" includes the Carbon Lehigh Intermediate Unit, LCCC, and local college and business representatives, including the Business Education Partnership. According to a local brochure,

Career Pathways guide students of all ages through a process to realistically prepare them for a promising future. To help graduates compete in a job market that requires more and more technological know-how, Career Pathways is designed to provide all students with the academic and technical skills they need to reach their career goals.

The process for the Career Pathways includes: 1) career awareness at the elementary school level, 2) career exploration at the middle school level, 3) career preparation at the high school level, including the selection of one of four career clusters at the 9th-grade level, 4) career development at the postsecondary level, and 5) career and lifelong learning. The career preparation stage of the Career Pathways is particularly important because this stage emphasizes choices of career-technical and academic education. Students not only choose one of four career clusters (arts and humanities, business and communication technology, engineering and industrial technology, and health and human services), they also choose one of two academic pathways within the clusters (*traditional academic* - leading to jobs requiring four or more years of college) or technical academic (*technical academic* - leading to jobs requiring associate degrees or advanced technical training.)

In the view of local educational leaders, Career Pathways has provided the initial momentum for subsequent collaborative educational initiatives for both the public school systems and the college. Networking among partner organizations has improved, creating opportunities for additional projects, grants and programs. Again, though not duplicative of CCTI, initiatives like Career Pathways and the Tech Prep Demonstration Grant, have helped to lay the groundwork for subsequent CTE-related initiatives such as the CCTI.

The CCTI grant was supported by the public school superintendents, the CLIU 21 Curriculum and Instruction County Committee, the Superintendent's Councils for the Area Vocational Technical Schools, the Lehigh County Career Pathways County Steering Committee, LCCC administration and faculty, and key business representatives. A common purpose of the CCTI is to capture and focus the energies and support of various partners to contribute to a collective culture. By collective culture. local educators are referring to creating a comprehensive mission and sense of purpose because it is important that all partners have a comprehensive sense of mission.

LCCC interacts with the business community through the Lehigh Valley Economic Development Corporation and the Lehigh Valley Chamber of Commerce. A primary partner is Lehigh Valley Business Education Partnership, which began in 1986. This organization was formed to address the needs of both business and education to communicate and collaborate to enhance education for the youth of the valley. Economic development was another major motivator for strengthened partnerships between education and business and industry, particularly in predominant sectors of the local labor market involving various forms of chemical manufacturing. The top occupations in the area are chemical and other types of engineering, secretaries, management support workers, plant and system operators, accountants and auditors, and physical scientists.

The CCTI Project

The focus of the CCTI project is to supplement the region's already strong commitment to a program known as "Academic Literacy in the Content Area", involving training and mentoring of teachers of science, math, and technology in the use of reading strategies to improve students' reading achievement. The Academic Literacy program is based on a research-based model called Reading Apprenticeship (RA) developed by WestEd's Strategic Literacy Initiative. A complimentary aspect of the project is to develop dual enrollment course(s) in science to give high school juniors and seniors early exposure to biotechnology. The stated goals of the program are to:

- Train teachers to use reading literacy strategies that help students learn science content more effectively.
- Help high school students increase their independence and effectiveness with reading and learning science.
- Create greater awareness among students about science and technology careers.
- Provide juniors and seniors access to college courses while still in high school.
- Prepare students for the transition from high school to college, lessening the need for remediation courses upon entry into college.

Once the program is well on its way in science, LCCC intends to facilitate the same process with mathematics, building from lessons learned with the science content area.

In the first year of the CCTI project, staff development was a primary focus. The original goal of the project was to train 30 teachers in 2003; however, due to time and funding constraints, only seven science teachers were trained during the initial summer, with five of these trained by West Ed. The seven trained science teachers are now applying Academic Literacy in their classrooms. In addition, the CCTI project requires that trained teachers participate in a classroom-level, quasi-experiment wherein one classroom is assigned as a treatment group with a science teacher trained in Academic Literacy and another classroom is assigned as control group with a science teacher who has not been trained. Students' reading competence is assessed at the classroom level and group differences are assessed. The research design and instrumentation for this aspect of the project has been carried out by local project leaders, Dr. David Fallinger and Dr. Deanna Quay.

Secondary science faculty who participated in training during summer 2003 in the Academic Literacy Institute are expected to use their new learning, and they are expected to share their learning with other faculty in their departments. The CCTI grant also identifies a Trainer/Coordinator to serve as a coach and co-facilitator with the new trainees to help to increase the likelihood of success of the project. Equally, this person will be able to nurture the involvement of departmental colleagues in the member schools for participation in the project and aid in its development and expansion. A primary strategy is to train a sustainable core of teachers using the West Ed Organization who can return to the local schools and train a larger group of teachers, utilizing of a train-the-trainer model to develop an ever-widening circle of teachers who are knowledgeable of the initiative. This will be achieved by using a model that starts with an initial phase of training that will be completed in one week on the local level, then teachers from this group will be offered the opportunity to train at West Ed's National Institute. Once teachers receive the West Ed training and return to the area, they will become trainers for other teachers in their school or region. It is the expectation of local administrators that Academic Literacy will proliferate throughout the schools in the region, eventually being transferred from science to the content area of math.

In the future, specialized training with the West Ed Organization will be used to grow the number of trainers through the use of summer institutes over the next four years. As a significant nucleus of science teachers are exposed to and trained in the project, the initiative is expected to be self sustaining. Also, school districts, along with the Intermediate Unit, are expected to offer interdisciplinary team training opportunities that are expected to evolve with the growing participation of partner district members. Additionally, training opportunities in Academic Literacy will be provided to college faculty involved in science, math and technology as well as reading and support services. The latter groups are included because they are expected to be better prepared to help students who participate in the learning support area of LCCC.

With respect to the development of the new dual enrollment course in biotechnology, local CCTI leaders have complied with LCCC's established protocol-template and process for the design of new curriculum. Research with education and industry was conducted, along with advisory committee input from business partners. The new biotechnology course, now completed and

offered at the college level for the first time in spring 2004, is available for use as a dual enrollment course. Work continues with the high schools to determine where the course will fit into secondary curricula in terms of state competencies.

Further, significant changes are occurring with LCCC's nanotechnology program. During summer 2004, the nanotechnology curriculum is undergoing a major review. Several meetings are planned with representatives from industry, the LCCC technology and science divisions as well as LCCC administration. In part, this review is geared to positioning the nanotechnology program to take part in articulation programs with four-year institutions. Part of the revision process includes plans for an introductory course in the nanosciences that can be used as the nanoscience dual enrollment. This revision process puts LCCC approximately one year behind in its plan for the introduction of this course to the high schools. However, the changed plan offers the potential for much better in the end, taking students through an articulated program from high school to 4-year college.

It is important to note that local CCTI leaders, particularly CCTI Program Director and Manufacturing Technology Project Director Dr. David Fallinger, see the CCTI grant as complementary but quite unique from other CTE grants acquired by LCCC. Several times during my interviews Dr. Fallinger pointed out the region's national reputation for CTE, mentioning LCCC's success with acquiring the federal Tech Prep Demonstration grant in manufacturing technology. He talked about LCCC's intent to implement a middle college high school, noting that an area career center adjacent to LCCC makes it possible to co-mingle students from the secondary and postsecondary levels in ways not possible in other locales. He talked about the middle college high school as a vehicle to facilitate "students coming back and forth between the two facilities all day long." Dr. Fallinger also mentioned that LCCC has many tech prep articulation agreements, many of which have been in place for many years. In a June 18, 2003 press release, Dr. Fallinger described the CCTI initiative as emphasizing academics to compliment CTE:

> *'The program is not about just reading better,' said Dr. David Fallinger, Director of Manufacturing Technology and CCTI Project [sic] Director at LCCC. 'It's about learning how to read better and developing an adaptation that enables a student to experience lifelong literacy within a certain content area, like science or mathematics.'*

CCTI Organization and Governance

Partner representatives play a governing and oversight role in the CCTI project. Primary among the various organizational partners is LCCC and also the Carbon Lehigh Intermediate Unit 21 (CLIU 21) that plays a key role in administration and curriculum and instruction staff. In addition, the public school districts that comprise the CLIU-21 and area vocational-technical centers sponsor secondary teachers for academic literacy training with the Intermediate Unit or West Ed. Others active in leading the CCTI include a small group of science and manufacturing technology staff and faculty at LCCC who are involved in the project and business representatives usually involved with the Lehigh Valley Business Education Partnership.

The site partnership team includes Dr. Fallinger, CCTI Program Director and Dr. Deanna Quay, Project Director, plus Dr. Donald Snyder, LCCC President; Ms. Susan Keck, Director of Curricula and Instruction, Ms. Jackie Sham, Professional Development Coordinator and CCTI Trainer-Coordinator, and Ms. Natalie Reichl, Educational Consultant—Reading and Special Education Programs, of CLIU-21; Holly Morris, LCCC Biology Professor; three secondary educators including a Director of Curriculum and Instruction, a teacher who offers both math and science, two business representatives (Air Products and Chemicals, Inc. and Silberline Manufacturing Inc.); the Executive Director of Lehigh Valley Business Partnership; the Director of Institutional Research and Effectiveness, LCCC; and the Director of Educational Support Services, LCCC. At present, the site partnership team does not include personnel from Technology Education but an LCCC administrator may be added once the nanotechnology curriculum initiative moves forward. Since the initial focus of CCTI was science and math but has now expanded to include technology education, technology representatives from the secondary and postsecondary levels will be sought.

With respect to funding, the project began with support of participating secondary institutions and the CLIU 21 in that $30,000 of local funding was provided for the initial West Ed. Training. Following their travel to California, six teacher/leaders delivered two 5-week training sessions during summer 2003, resulting in a substantial invest of local funds in 10 days of planning in the design and development of the two summer training institutes in Academic Literacy for local teachers. The individual participating districts sponsored 72 teachers for summer institute training in areas other than science at the high school and various subjects at the middle school level.

The CLIU 21 Organization, the service coordinator and provider for the 14 sending and sponsoring school districts is serving as the primary provider for the Academic Literacy Initiative and Grant Project. According to local officials, no special facilities are required for this project because the CLIU 21 provides rooms for staff development training. In the second phase of the project, secondary partners will be requested to use local facilities and equipment for dual enrollment courses provided by LCCC.

CCTI Project Plans

The MVTPC implements its CCTI plans for the ET pathway project, the five established goals of the CCTI improvement plan are to be addressed as follows:

To reduce the need for remediation, educators associated with the CCTI initiative will develop and deliver a one-week long training institute in academic literacy for high school science teachers. Their assumption is that improved literacy skills will enhance students' comprehension of the text and other materials, and therefore decrease their need for remediation upon entry into the community college. A content-related pre- and post-test will be given in classes taught by reading apprenticeship (RA) high school teachers and non-RA high school teachers, and first and last quarter grades by RA and non-RA trained teachers will be compared. Remediation will be measured for the two groups upon entering college, three years after the start of the program. To carry out the research, teachers who participate in the training will identify a science class and apply the academic literacy strategies. They will develop a structure to collect pre- and post-test

data for both the treatment and comparison groups, and they will administer the COMPASS test. Data will be analyzed and reports prepared for CCTI.

In addition, the National Institute on Reading Apprenticeship (NIRA) will be advertised with workshop participants, with support from CCTI provided to send teacher leaders to the NIRA training. Follow-up will be conducted. Over time, the local partnership strives to train more teachers because "the more teachers we can train, the more students we can reach with our program," and the better chance to reduce remediation. This activity will be facilitated through the design of a faculty support model for academic literacy, which is based on a basic turnkey training model wherein teachers attend training and are supported with additional workshops, the presence of the trainer–coordinator, and the establishment of learning communities. As more teachers are trained, the more they support each other. In addition to the local training, NIRA training is being provided and NIRA-training teachers come back and do the actual more professional development/training. The approach is intended to be a self-sustaining method, once there is a large enough nucleus. Enrollment in the June training is not available as of yet, but a pre-workshop on April 22, 2004 drew 52 science, math and technology instructors from 10 public middle schools and high schools, 2 area vocational-technical schools, 2 parochial high schools, and LCCC. (The CCTI grant covers the cost of the training for instructors from the public high schools and LCCC; others attend by paying for training from local funds.)

To increase enrollment and persistence in postsecondary education, develop and deliver science/technology dual enrollment courses. An *Introduction to Nanofabrication* survey course is in the initial stages of development for high school students and LCCC students interested in the Manufacturing Technology (MT) Nanofabrication cluster. The course will be offered by the LCCC's Science program. The goal is to use the Nanofabrication survey course as an overview for students to introduce them to opportunities available to them in LCCC's Manufacturing Technology Nanofabrication Program. After creating the course through a collaborative planning process and getting it approved by LCCC administrators, local plans call for the course to be piloted in one high school and then transferred to other high schools in the region. Student enrollments will be tracked over time.

To improve the academic and skill achievement of students at the secondary and postsecondary levels, the local partnership plans to use the academic literacy course offered to high school teachers of science and math. When trained and delivered to students, teachers are expected to use the reading apprenticeship (RA) to improve student comprehension in content-related courses. The quasi-experiment is being used to assess student literacy comprehension and provide a measure of academic achievement. Further, the dual enrollment course is viewed as a method for enhancing skill achievement. Other aspects of these strategies identified in the LCCC plan were discussed above, and are not repeated here.

To increase the number of postsecondary degrees, certificates, and licensures, the CCTI initiative plans to offer academic and career-related counseling, and develop articulation agreements with 4-year colleges. Multiple communications and marketing will be provided for guidance counselors, administrators, and content area teachers (science, math, technology) and dual enrollment programs. Increased communication between the secondary and postsecondary institutions is expected to enhance enrollments and degree completion. Local officials anticipate

seeing increased numbers of students matriculating from high school to LCCC, with increased numbers of students in technical programs at the college. Graduation rates in the targeted programs will be compared over the next few years to graduation rates before the CCTI was implemented.

To improve entry into employment and/or further education, the CCTI initiative plans to expand employer initiatives, including working closely with local employers to increase the likelihood of placing students in high paying, high demand employment. Local officials also plan to focus on enhanced alignment and articulation with baccalaureate programs to increase the likelihood that students will continue into a 4 year college. Educators hope that local employers will create more opportunities for students to enter high paying, high demand occupations, and that students will get more opportunities to enter 4 year college. Measures of success of this outcome include increased numbers of students furthering their education. Students will be surveyed after graduation to find out their plans for work, school, or other activities. Local officials plan to carry out this research over the four years of the project to see if students experience higher paying jobs and continue into 4-year programs a increasing rates. In addition to tapping existing employers and 4-year colleges, local officials plan to solicit new industrial contacts and four-year colleges and universities.

Evaluation of the CCTI Project

LCCC will be responsible for coordinating the evaluation component of the project. LCCC's institutional researcher is responsible for identifying students who will take part of the student follow-up evaluation, and in managing the research and data collection. The secondary partners will be responsible for data collection and transmitting the data to LCCC with support from the Project Director, Deanna Quay. New data were collected beginning with the 2003/04 school year consistent with this initiative, and the data collection will continue throughout the project's lifetime.

Both quantitative and qualitative data will be collected. Exit evaluations will be used to evaluate the local and national training sessions for the purpose of improving the training. Of more interest is the effect of RA on student achievement. Currently, student achievement is being assessed using quarter grades (first compared to last), and data have been collected from a few classes using block scheduling. Preliminary results are mixed. Thus far, quarter grades have not shown significant positive change, though the analysis did not control for competing factors and is therefore inconclusive.

Further, subject related pre and post tests are being piloted in several classes, but these tests have presented difficulties. The biology test (the college entrance exam) appears to have been too difficult for the applied biology classes with teachers reporting high levels of student frustration with the difficulty of the test. Also, teachers reported that, once students realized they were not getting a grade for the post-test, a number did not take the test seriously. Consequently, several teachers who have been through training have expressed a concern that this year's results may not be a valid assessment of the effectiveness of RA since there is a rather steep learning curve for teachers associated with developing an effective RA classroom.

LCCC is already already attempting to address these issues. First, teachers who were trained in RA in 2003 are being asked to continue in the program for the purpose of data analysis. This request exceeds the original commitment as the initial contract only required each individual teacher to participate for one year. Second, discussions are underway concerning refinements to the assessment tools. No decision has been made, but one suggestion has been made to tie the pre- post test to the course final exam. However, final exams are handled differently by different schools, and these decisions will require considerable discussion among next year's participants.

Our quantitative and qualitative data will be shared with partner institutions on a regular basis to help sustain the project as well as with CCTI officials. Results will be communicated to the IU Wide District committees including the Curriculum and Instruction Committee, the Reading Language Arts Committee and the various administrative councils, i.e. Superintendent's Council. Data will also be shared with joint councils of the College and the IU/sponsoring districts.