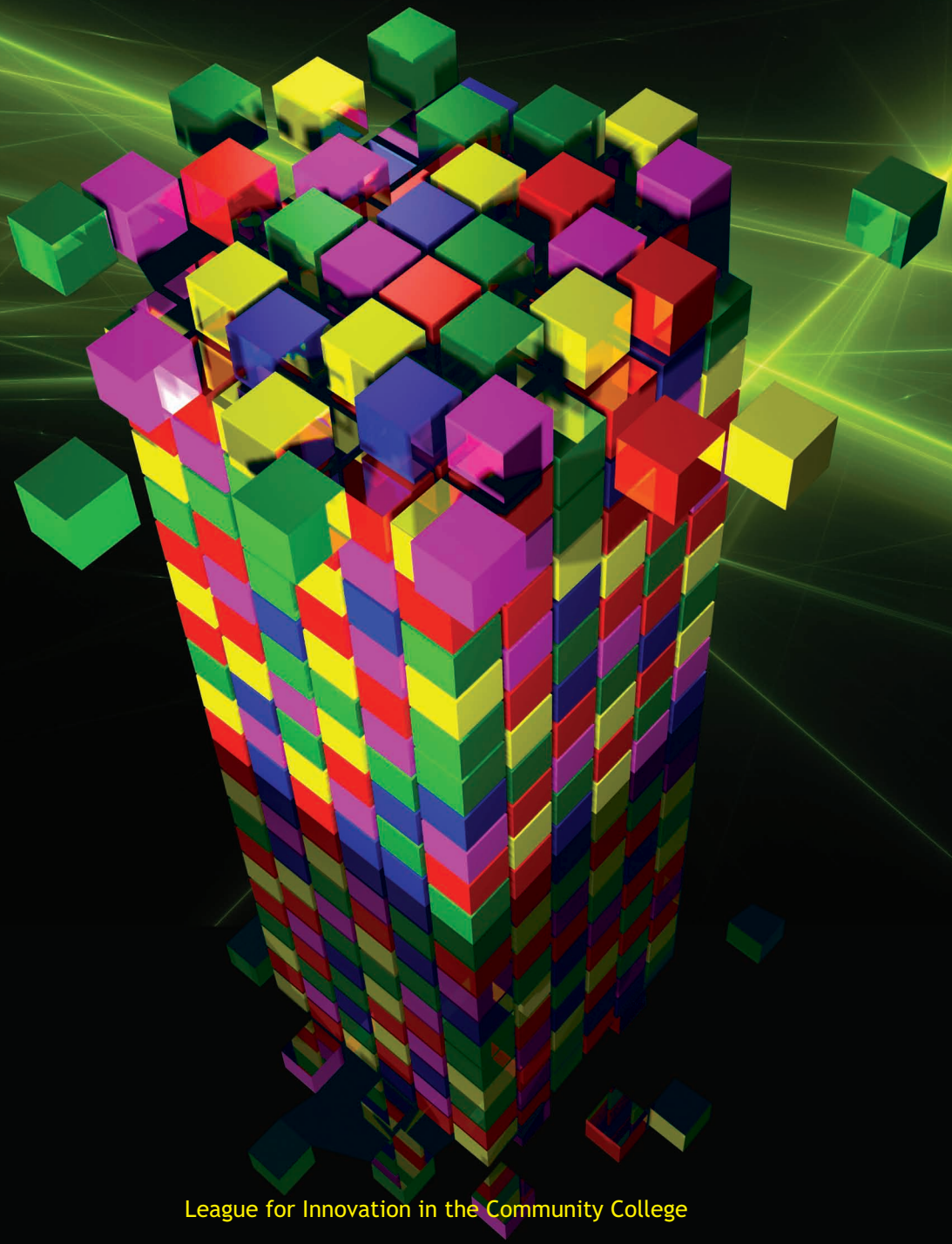
Significant Discussions

A Guide for Secondary and Postsecondary Curriculum Alignment



League for Innovation in the Community College

with support from

MetLife Foundation

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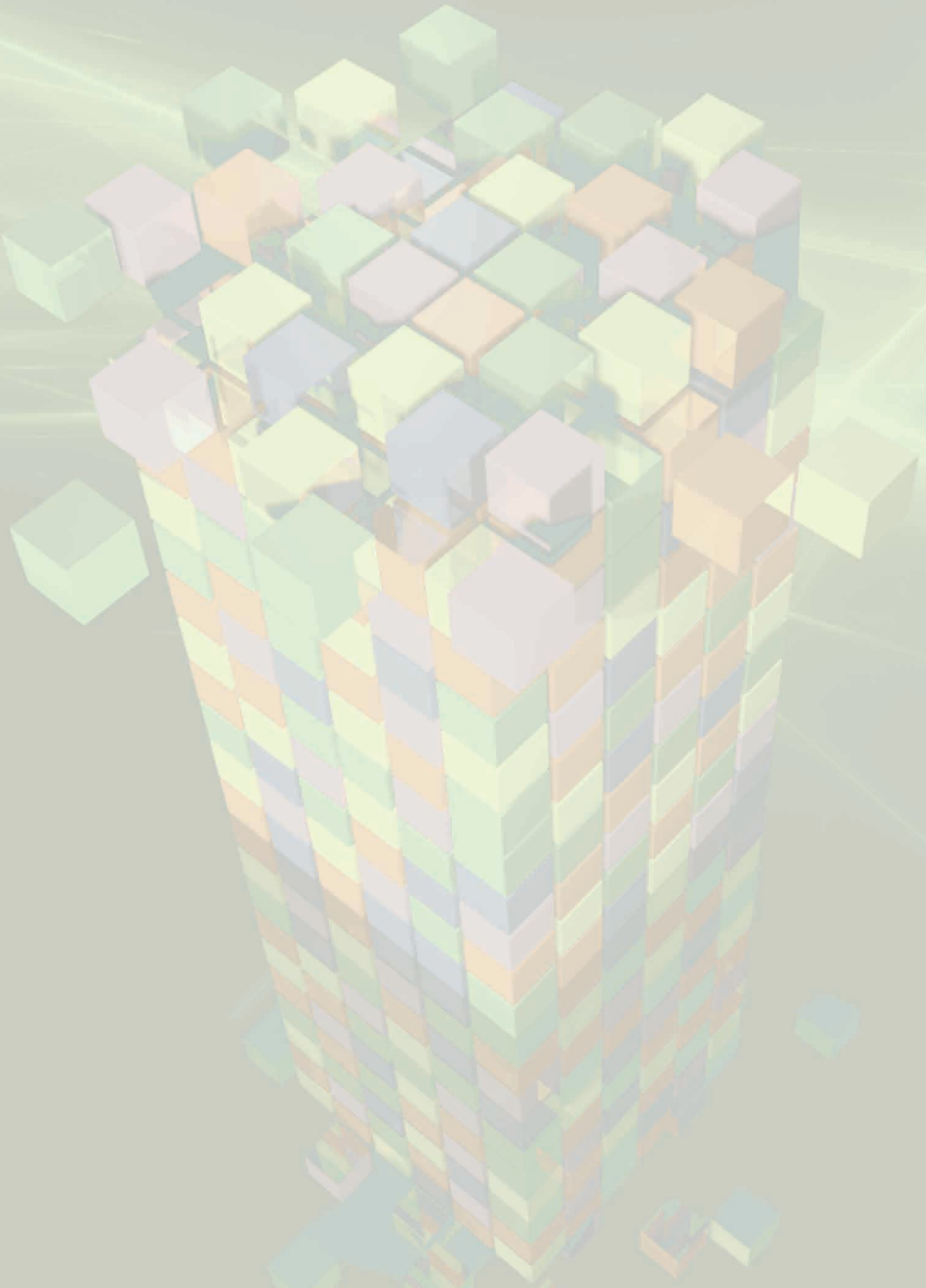

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The opinions expressed in this book are those of the authors and do not necessarily reflect the views of the League for Innovation in the Community College or MetLife Foundation.

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The purpose of the Significant Discussions guide is to assist diverse stakeholder groups—including but not limited to secondary school, community college, university, business, industry, and state department of education representatives—to engage in significant discussions that build and strengthen productive partnerships. The guide is designed to actively engage people in these partnerships in purposeful work that will result in smoother, more successful transitions for students as they progress along their educational pathway, across systems of education, and on to their life's work.

The need for a guide to help encourage, shape, and nurture such discussions became clear during the work of the College and Career Transitions Initiative (CCTI). CCTI was a multi-year project (2002-2008) funded by the United States Department of Education Office of Vocational and Adult Education and administered by the League for Innovation in the Community College. During the CCTI project, it was evident that misalignment of curriculum among secondary schools, community colleges, universities, and employers created barriers to student success. Further, it became apparent that collaborative discussions about curriculum alignment across educational systems were often random and voluntary. There are few systems in place to institutionalize or incentivize collaborative work to improve alignment. However, the Carl D. Perkins Career and Technical Education Improvement Act of 2006 requires that secondary, postsecondary, and business partners collaborate in the development of Programs of Study.

More recently, there has been a major emphasis to increase student success—particularly in the community college. The current administration has called for a steep increase in the number of students who complete some postsecondary work leading to a degree or certificate. Many private funders have also issued a challenge to educators to increase college completion with an emphasis on minority and low-income students. This thinking has led to numerous national efforts championed by influential groups, such as the National Governors Association, that are focused on increasing student success and completion.

With generous support from MetLife Foundation and leadership from the League for Innovation in the Community College, nine community college partnerships, selected from the original 15 CCTI college partnerships, have come together to create and refine this Significant Discussions guide. The guide is a valuable tool to help support and advance the work of collaborative partnerships across the nation and around the world. This guide will help meet the challenge of moving Significant Discussions from episodic conversations on the margins to systemic and mainstream practice that will have a positive impact on student success.

Laurance J. Warford
Principal Investigator

INTRODUCTION

More than ever before, in today's competitive global economy, a well-educated population is critical to the economic vitality and stability of a nation. We depend on our education systems to efficiently move learners through compulsory school levels and prepare them to succeed in postsecondary education and careers. Educational attainment is critical to our standing in the world—so much so that President Obama established the American Graduation Initiative. This initiative calls for a 50 percent increase in student completion rates at community colleges over the next decade, a completion agenda that takes on significant importance for this country. When looking at the movement of students from high school to postsecondary education and on to careers, we appear to have a leaky pipeline. A high percentage of students are not completing and moving to the next level. Consider these facts compiled by the National Center for Higher Education Management Systems (www.NCHEMS.org):

- 19.7 percent of ninth graders will graduate from high school on time, go directly to college, return for their second year of college, and graduate within 150 percent of program time (three years from a two-year college; six years from a four-year college);
- For every 100 ninth graders, 68.6 percent will graduate from high school on time (four years).
- For those who go to two-year colleges, 53.5 percent will return for their sophomore year.
- For those who go to four-year colleges, 75 percent will return for their sophomore year.
- Of those who go to a two-year college, 29.1 percent will graduate after three years (150 percent of program time).
- Of those who go to a four-year college, 56.4 percent will graduate after six years (150 percent of program time).

(Sources: NCES Common Core Data; IPEDS Residency and Migration, Fall, Enrollment, and Graduation Rate Surveys; retrieved from www.higheredinfo.org.)

Comparing these 2006 data to 2003 data, no significant progress has been made in the completion rates. Furthermore, comparing our educational attainment levels with those of other developed countries tells us that we have a lot of hard work to do to make the changes necessary to improve these conditions and begin to achieve the completion goals in the American Graduation Initiative. Making the necessary changes will take time and money. Clearly, there is no quick fix that will meaningfully increase educational completion levels, but just as clearly, this is a challenge that must be met. The components of this guide are designed to help meet that challenge. Combined with substantially improved career counseling, advising, and coaching, and with a commitment among systems of education to work together more effectively, we can help develop smooth transitions for students and improve our completion rates. Students must understand the relevance of the curriculum—"Why do I need to know this stuff?"—and they want and deserve help with a plan that takes them through high school to postsecondary education and into the workforce.

A major reason for the low completion rate is that the majority of students are not ready to succeed at the next educational level. Many recent high school graduates find themselves inadequately prepared to be successful in higher education and require enrollment in remedial or developmental education classes immediately upon entering college. Nearly half of all college students take at least one remedial course. In *Paying Double: Inadequate High Schools and Community College Remediation*, the Alliance for Excellent Education (2006) estimates the annual cost to provide remedial education for community college students who have recently completed high school is $1.4 billion. When the system struggles to achieve the intended outcome of seamlessly educating the population, we are compelled to search for solutions.

The Significant Discussions project was designed to develop a guide to facilitate discussions between secondary and postsecondary faculty and administrators, and business, industry, and community partners. The Significant Discussions guide will assist partnerships in their collaborative work to better align curriculum across institutions and educational levels. The guide is based on effective practices in place at nine participating sites and promising practices identified through research.

Methodology. The Significant Discussions guide is the product of an action research project involving educators and business partners across the country (see pages 54-57). With support from MetLife Foundation, the project facilitated the establishment of discussion groups at nine community colleges. The community college partnerships included each college's secondary, university, business, and community partners. Additionally, a national review panel of six individuals with expertise at various levels of education provided assistance on selection of the nine college partnerships and reviewed the guide twice during the iterative process used in its development.

Nearly half of all college students take at least one remedial course.

The 15 community college site partnerships that participated in the College and Career Transitions Initiative (CCTI) were eligible to apply to become the nine college participants in the Significant Discussions project. Fourteen of the 15 site partnerships submitted proposals and, after review of applications and submission of recommendations from the national panel, nine were selected to participate.

The initial draft document for the discussion guide was created using relevant research literature. This initial draft (Draft 1) was prepared by the Principal Investigator and the Project Assistant. The document evolved through an iterative process including eight review stages and subsequent revisions as a result of input from those reviews.

The nine community college partnerships were comprised of educators at various levels and business and community representatives (see pages 54-57). Partners reviewed the guide in preparation for partnership discussions. The principal investigator attended all nine discussions.

For purposes of review and revision of Draft 1, the nine community college partnerships were divided into three groups of three. Input from partnership discussions at the first three college sites was used to develop Draft 2 of the guide. Draft 2 was shared with the second group of three college sites. The process was repeated resulting in Draft 3 and then Draft 4 of the document.

Data from the college partnership participants and the national review panel members was gathered using an instrument that asked respondents to rank their level of agreement (strongly agree to strongly disagree) on six questions related to the various sections of the guide. In addition, general comments were solicited.

Following the formative reviews by the college sites, the national review panel members provided their initial formative review of Draft 4. The national review panel used the same review instrument as the college partners and provided input and recommendations for revision.

Draft 5 was developed using input from the national review panel and was submitted to the project staff in the League office for comment. Draft 6 was developed based on input from the Project Liaison and then distributed to the national review panel for their summative review.

Draft 7 was created using the national review panel input and was again submitted to the nine college partnerships for their review. The college project leaders forwarded the summative review input to the project staff and project liaison, who completed and edited Draft 8. The final document was completed in September 2010.

The Significant Discussions guide is organized into five sections, each presenting a phase in the process leading to systemic solutions that improve student transitions and college and career success.

Getting Started

The "Getting Started" section is designed to assist in identifying the right people to participate in a collaborative partnership. During this initial phase, "Why Significant Discussions?" (pages 7-13) serves as a common reading and provides a relevant research base to inform all partners about the existing conditions that negatively impact student transitions. "Why Significant Discussions?" is intended to help garner support from diverse members of the partnership and establish a foundation for the efforts ahead. A glossary of terms is included on pages 52-53 to clarify words and phrases that, in the context of this work, may be unfamiliar to some partners.

Gap Analysis

During the gap analysis, partners review the relevant essential and/or career cluster knowledge and skill statements. Secondary and postsecondary faculty review curriculum in order to identify when and where the knowledge, skill, or standard is delivered. The gap analysis helps to uncover whether, and which, critical elements are missing in the curriculum. Gap analysis tools are included in Appendix A.

Curriculum Alignment

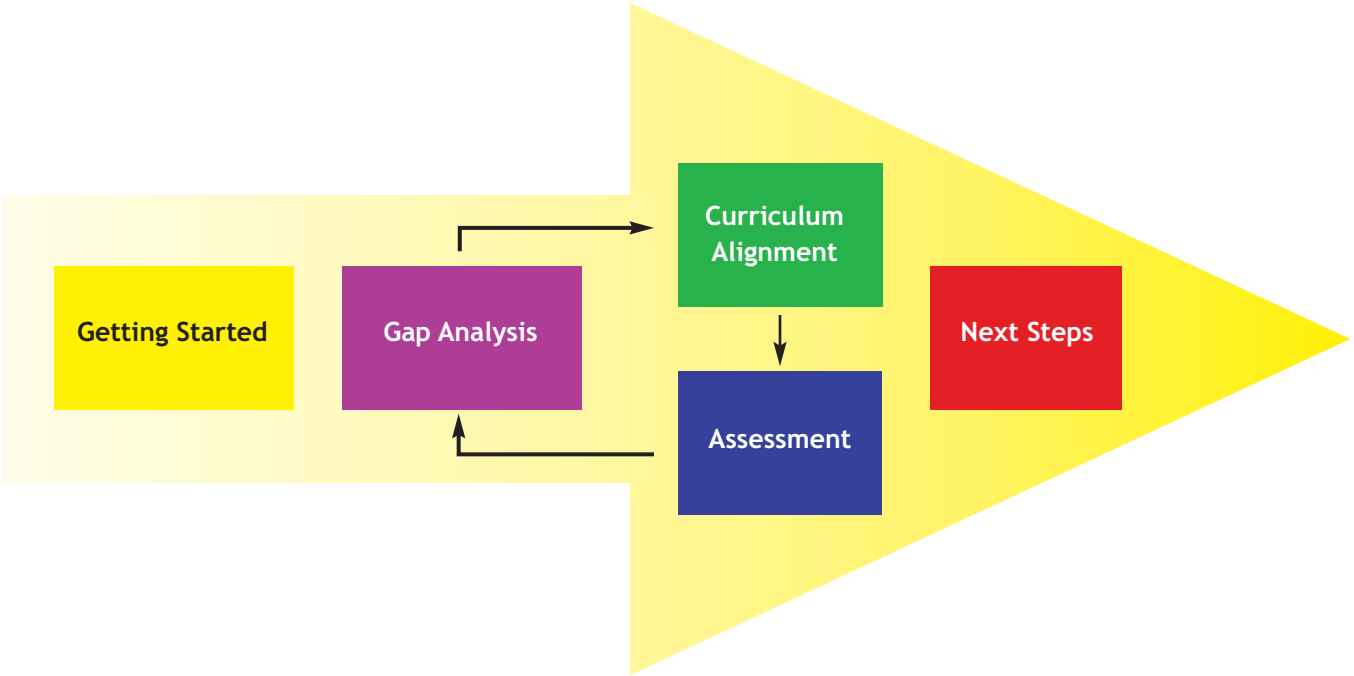
In the curriculum alignment phase, secondary and postsecondary faculty use the results of the gap analysis as they revise curriculum. Special attention is given to closing gaps and filling in any missing knowledge, skills, or standards. Where overlaps or duplications occur, depth of knowledge should become more complex, requiring higher orders of thinking. Curriculum alignment tools are included in Appendix B.

Assessment

The fourth section, "Assessment," offers several strategies to determine whether curriculum alignment changes have produced the intended results. The gap analysis, curriculum alignment, and assessment phases form an ongoing continuous improvement cycle as indicated by the Significant Discussions diagram below. Assessment results inform subsequent gap analyses, which in turn guide future curriculum alignment work. The cycle repeats regularly to ensure that curriculum remains relevant, current, and effective.

Next Steps

The "Next Steps" section provides recommendations at a system level and also offers action steps that each institution and individual stakeholder can take, even as the systemic changes evolve.



According to Kati Haycock (2009, ¶9), president of the Education Trust, "Back in the 1990s, it started being clear to us that a whole lot of kids who were following all the rules and doing fine on exams in high school were entering college and finding themselves having to take remedial courses and learning things they should have learned in high school." In the Achieve, Inc., report, *Out of Many, One: Toward Rigorous Common Core Standards*, Kramen and Eresh report a similar experience: "Too many students across the country meet K-12 state standards, pass state tests, and complete state-required courses only to be placed into remedial courses once they enroll in college or to find they are unqualified for training programs and skilled employment in the modern workplace" (Achieve, Inc., 2008a, p. 1). Why does this happen? How can there be such a misalignment between what students learn in high school and what they are expected to know and be able to do once they get to college? What steps can be taken to improve this situation?

> This tragic waste of human resources will not only condemn millions of adults in the next generation to unfulfilling lives marked by low-wage jobs and unrealized potential, it will threaten the economic security and social stability of our states and nation.
>
> Gene Bottoms and Marna Young
> *Lost in Transition*
> Southern Regional Education Board
> High Schools That Work

K-12 School Systems

School systems generally spiral curriculum vertically from Kindergarten to grade 12 (K-12). Children learn foundational knowledge in elementary school and build upon that foundation through middle and high school. Ideally, the knowledge and skill base of every student approaching graduation from high school will adequately support that young person's future educational and career goals, whether he or she intends to go directly into the workforce or continue his or her education. Organizations such as the National Governors Association and initiatives such as the American Diploma Project claim that the skills and knowledge necessary to be successful in college or the workplace are nearly identical. In *Claiming Common Ground*, the authors note that, "many of the efforts to improve secondary schools have targeted student readiness for both college and work as a single key objective: the skills and knowledge required for middle-income jobs closely mirror those required for college success (Callan et al., 2006, p. 1).

One might conclude that such a shared vision of college and career readiness would simplify the work of K-12 schools. Yet the Education Trust's "Ticket to Nowhere" (1999) notes,

> Colleges don't agree among themselves about the exact nature of needed knowledge and skills, and consequently, where high school ends and 'college level' work actually begins. The business community is not better. Business Roundtable and National Alliance of Business may urge schools to focus on high-level reading, writing, mathematics, and analytic skills. But members of the local Chamber are as likely to stress the importance of things like punctuality, courtesy, teamwork, and basic reading and math skills.(p. 4)

As much as K-12 schools may want to focus their attention and resources on attempting to clarify college and career readiness standards and align instruction accordingly, they are instead held accountable for achieving standards defined by their respective state departments of education. High-stakes exams measure how well students and schools meet those established state standards, and although students are required to pass the designated exam to receive a high school diploma, the standards on these exams often are calibrated at around a tenth-grade level.

A Confounding Disconnect. Venezia, Kirst, and Antonio (2004, p. 2) describe the perplexing relationship between high school and college: "The coursework between high school and college is not connected. Students graduate from high school under one set of standards and, three months later, are required to meet a different set of standards to enroll in college."

This sends a confusing message to high school students and their parents, who believe that passing an exit exam signals a successful conclusion to the high school experience and implies college readiness. Sadly, more confusion may await them as they transition to college.

College Transition

Community colleges are generally publicly funded, open-admission institutions that offer associate and certificate degrees as well as professional and technical certifications. The phrases "open admission" and "open access" are common in the community college lexicon, but can be perplexing for those unfamiliar with the true meaning. Although some community college degree programs are selective, compared to colleges or universities with challenging admission standards or competitive selection criteria, open access implies that anyone may attend. Bottoms and Young (2008, p. 14) explain, though, that "open admission does not always mean admission to credit-bearing courses leading to a degree. For many students, it means taking remedial or developmental courses to become college-ready and acquire skills that should have been developed in high school school." Callan et al. (2006, p. 5) further explain that, "Since these broad-access institutions do not have stringent admission requirements, many high school students assume that they do not need rigorous academic preparation to attend a community college. They do not understand that community colleges have academic standards for taking college-level courses and completing a certificate or degree program."

Of course, the need for remediation for returning adult learners will continue since some individuals may need to refresh knowledge and skills they have not used regularly since leaving formal education systems. For purposes of this guide, however, the primary concern is the need for remediation among recent high school graduates.

The Impact of Placement. After applying for admission to a community college or university, students take a placement exam that usually measures reading comprehension, writing, and math skills. The results of the exam help determine whether students are academically prepared to handle the rigor of college-level courses. If a student's placement score falls below a cut-off point established by the college, the student is advised or required to take one or more remedial courses before enrolling in college-level classes. Unlike college-level courses, remedial courses do not typically earn required credits for certification or graduation. In addition, tuition for remedial classes is usually equal to tuition costs for courses that apply toward certificate or graduation requirements. Participation in remedial courses adds cost, potentially escalates student loan debt, increases time to completion, and can have a demoralizing impact on student confidence and motivation.

The cost of remedial education is staggering. In *Diploma to Nowhere* (Strong American Schools, 2008), the authors estimate entering college freshmen and their families pay $708 to $886 million in remedial education tuition and fees. Table 1 includes data for

Table 1. Scope and Cost of Remedial Education for All Entering College Freshmen

	Number of Students in Remediation	Tuition and Fees	Subsidies*	Cost of Remediation (assuming 2 remedial courses)
Public two-year	995,077	$513-$642 million	$1.37-$1.71 billion	$1.88-$2.35 billion
Public four-year	310,403	$195-$244 million	$239-$299 million	$435-$543 million
Total	1,305,480	$708-$886 million	$1.61-$2.01 billion	$2.31-$2.89 billion

*Subsidies include revenue from state appropriations as well as revenues from other sources including private gifts and investment returns.
Compiled from information in Strong American Schools, *Diploma to Nowhere* (2008).

all entering college freshmen at public two- and four-year institutions. These figures represent the cost to all entering college freshmen, some of whom may not be recent high school graduates. Consequently, Table 1 calculations are higher than the *Paying Double* figures cited in the Introduction of this guide, which represent remediation cost for recent high school graduates attending community college.

In *Paying Double: Inadequate High Schools and Community College Remediation*, the authors explain that,

> In addition to the expense students and families bear, taxpayers cover the direct and indirect instructional costs of remedial courses through the subsidies community colleges receive from state and local government. These tax dollars are above and beyond the taxes allocated to support local secondary schools. Thus, taxpayers are essentially paying twice for the coursework and skill development students are expected to receive in high school (Alliance for Excellent Education, 2006, p. 3).

Students who stop out or drop out of college often have student loans to repay. Meanwhile, these individuals still do not have a degree or certificate of value that qualifies them for more and better jobs that pay a family supporting wage. At best, participation in remedial courses increases time to completion (see Table 2). The Strong American Schools (2008, p. 12) report, *Diploma to Nowhere*, notes that, "Even more worrisome, though, is that students who participate in remedial education are much more likely to drop out before completing a degree."

Table 2. Degrees of Remediation

Students who require:	Graduate within 8 years
No remedial courses	57%
One or two remedial courses	29%
Four remedial courses	19%

Compiled from information in Strong American Schools, *Diploma to Nowhere* (2008).

Collaborative Partnerships

A major national project, the College and Career Transitions Initiative (CCTI), demonstrated how significant discussions among strong collaborative partnerships can help to smooth student transitions and help more learners achieve their education and career goals. Participating colleges found that discussions among schools, colleges, and business partners can help improve these conditions and strengthen linkages that align standards for high school graduation, college admission, and enrollment in credit-bearing courses.

As Bottoms and Young (2008, p. IV) assert, "Many collaborative partnerships between high schools and colleges are voluntary and efforts are often episodic and dependent on local personalities rather than on a uniform set of state policies." Colleges, universities, and business and community organizations should, but often don't, partner to engage in reform efforts that align high school and college standards and curriculum to accurately reflect what students need to know and be able to do in college. There are few vehicles in place to encourage the two systems of education to communicate with each other, much less to collaborate to improve student achievement across institutions. Callan et al. (2006, p. 2) charge that, "No one is held responsible for the students who drop between the cracks of the two systems."

This kind of accountability is difficult to achieve. As Callan et al. (2006, p. 2) explain, "Currently, the K-12 standards movement and efforts to improve access and success in higher education are not connected." Bottoms and Young (2008, p. 15) further explain:

> In most state accountability systems, reducing the remediation rate is not a performance factor for either high schools or two-year colleges; thus, it is not often a priority for either. Most states lack a comprehensive state policy that fosters partnerships between community colleges, state departments of education, and local school districts to implement a systematic approach to reduce remediation among recent high school graduates.

In "Ticket to Nowhere" (1999), the Education Trust proposes thinking of standards in a K-16 way as a critically important foundation for reform work. The authors of Paying Double (Alliance for Excellent Education, p. 4) advise that, "Content and coursework across the systems should align with the skills and knowledge students need in today's increasingly competitive and demanding world."

In *Raising Our Sights: No High School Senior Left Behind* (Woodrow Wilson National Fellowship Foundation, 2001), the authors propose:

> What is required is the building of new bridges between K-12 and postsecondary education, bridges that are broad, substantial, and frequently used, with traffic running both ways. It is time to move beyond separate systems, in which curriculum and assessment systems in K-12 and postsecondary education bear little relationship to each other, to a more seamless system in which standards, curriculum, and assessment efforts between the two systems are aligned and integrated. In truth, what is required is a new commitment to a single system of 'P-16' education, in which the sights of everyone at every level of the system are raised to take into account new requirements, challenges, and expectations. (p. 20)

CCTI demonstrated how collaborative partnerships positively influenced curriculum alignment and helped to smooth student transitions. Fifteen community college partnerships in five occupational areas worked to develop career pathways that would help to achieve the following five outcomes:

- Decrease the need for remediation at the postsecondary level;
- Increase enrollment and persistence in postsecondary education;
- Increase academic and skill achievement at secondary and postsecondary levels;
- Increase attainment of postsecondary degrees, certificates, or other recognized credentials; and
- Increase entry into employment or further education.

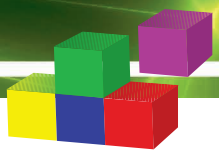
During the life of the project (2002-2008), four practices emerged as the most promising elements to ensure success. Collaboration, communication, counseling, and curriculum alignment—the 4 Cs—are considered to be essential for creating a shared culture that supports successful student transitions (Kempner, 2008). (See Table 3.)

Collaboration among partners and across the education, business, and government sectors needs to be supported by strong leadership. Helping students successfully

Table 3. College and Career Transitions Initiative Promising Practices

COLLABORATION	**Collaboration** among partners and across the education, business, and government sectors needs to be supported by strong leadership.
COMMUNICATION	**Communication** among all the partners, faculty, counselors, and supporting staff is critical to ensure that collaboration is effective and long term.
COUNSELING	**Counseling** functions provide information to ensure that students know what academic skills are needed to transition effectively and how to acquire those skills.
CURRICULUM ALIGNMENT	**Curriculum alignment** creates seamless pathways necessary for student success across educational levels to students' future careers.

Source: An unpublished report prepared by K. Kempner for the League for Innovation in the Community College's *College and Career Transition Initiative Executive Summary: General Overview of Findings*, 2008.



transition from secondary to postsecondary education and onto careers requires the collaboration of multiple institutions, organizations, and employers, and commitment from high-level leaders.

Communication among all the partners, faculty, counselors, and supporting staff is critical to ensure that collaboration is effective and long term. With the support of high-level leaders, faculty, staff, and counselors are the functional experts positioned to design and develop the processes that will enhance student success across systems.

Counseling functions provide the information to ensure that students know what academic skills are needed to transition effectively and how to acquire those skills. Students should have access to knowledgeable individuals to assist them in developing a realistic college and career plan based on accurate information about the necessary requirements to achieve their education and career goals.

Curriculum alignment creates seamless pathways necessary for student success across educational levels to students' future careers. College and high school faculty should work together in a respectful, trusting, and supportive manner to align curriculum across educational levels and enable students to smoothly transition to the next level without knowledge or skill gaps.

These 4Cs are shared across educational levels—high school, community college, and university—and with business and community partners, resulting in all stakeholders feeling more comfortable talking with each other. Support for these partnerships should come from high-level leaders such as college presidents, school superintendents, and key community and industry leaders such as corporate CEOs. The commitment of high-level leaders is crucial to help develop and sustain systems that ease transitions and contribute to student success. This commitment sends the message that collaborative work is important, and support from the top justifies the dedication of resources to support and advance the work that will result in improved student outcomes.

The activities on Worksheet A (pages 12-13) are designed as a reflective exercise for your group. Use the worksheet to help kick off your significant discussions.

WORKSHEET A: Why Significant Discussions?

The following questions may help you and your partners clarify and enhance understanding of the issues and challenges. You may choose to add other questions that are relevant to your partnership.

1. In reading the "Why Significant Discussions?" section, what did you learn that surprised you most?

_____

_____

_____

_____

_____

_____

_____

_____

_____

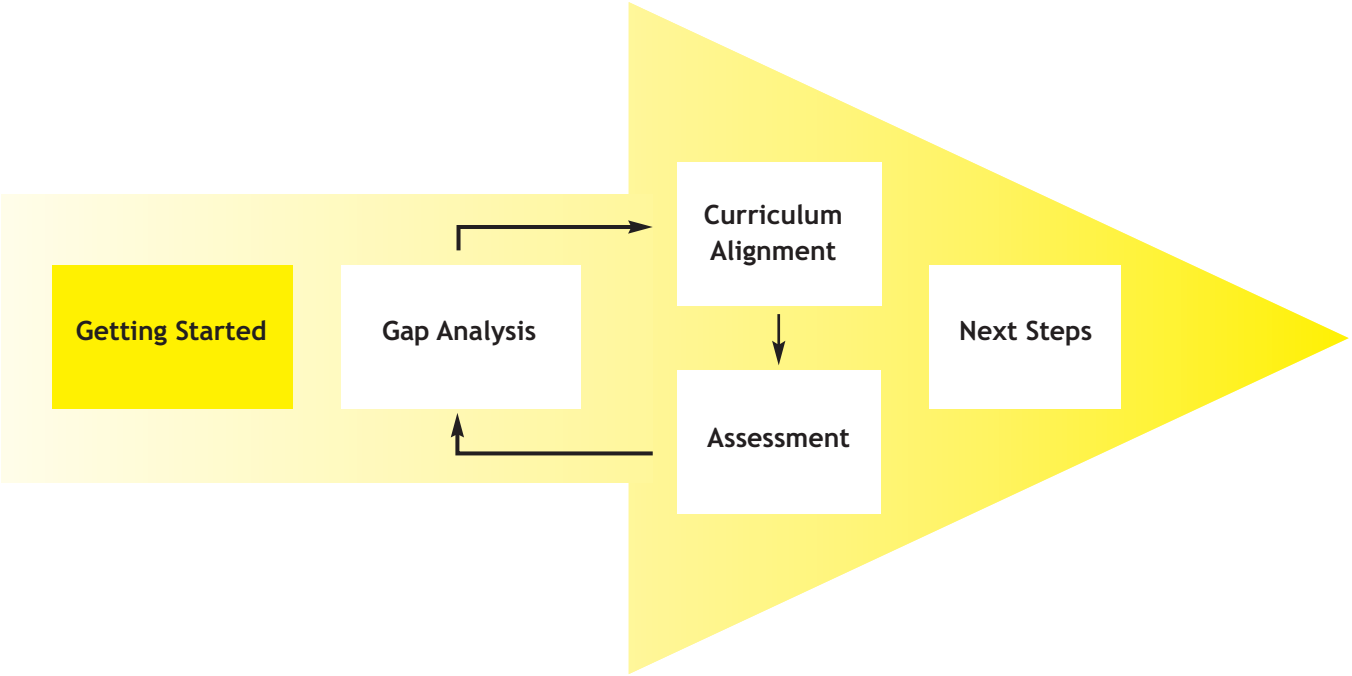
2. What did you learn that you did not know about

a. secondary schools?	b. community colleges?	c. universities?

3. What questions do you have or what points do you need to clarify about

a. secondary schools?	b. community colleges?	c. universities?	d. industry needs?

4. What additional information or details would help you better understand the need for collaborative partnerships to engage in reform efforts?



Perhaps you have a collaborative partnership that has been working together successfully for many years—creating and revising curriculum and career pathways across various sectors. Maybe you are starting a new partnership—just becoming acquainted with each other. Regardless of the circumstances, you clearly recognize the best approach to improve systems and enhance student success is to form strong, respectful, and productive partnerships among secondary schools, postsecondary institutions, and business and industry associates. In the Getting Started phase, the following four steps will help set the stage for productive, effective Significant Discussions.

Getting Started Essentials

1. Get the right people around the table.
2. Understand the issues and challenges.
3. Develop trusting relationships.
4. Identify goals.

Step 1: Get the right people around the table.

Partnerships should include various stakeholders across K-12 schools, community colleges and universities, and business and industry employers. These participants should also represent the demographics of the students served by the partnership. It may be practical to build upon existing partnerships like department or program advisory boards or dual credit and articulation review teams. In some cases, it might make sense to redesign or modify an existing advisory board or review team, particularly if the participants, conditions, and goals have changed significantly since the group was originally formed. In other cases, starting an entirely new group may be appropriate. Consider including the following representatives in your partnership discussions:

- Three to five content experts (i.e., faculty, curriculum specialist) from both the secondary school and community college
- One or two administrators (i.e., curriculum director, dean, or division head) from both the secondary school and community college
- One or two counselors or advisors from both the secondary school and community college
- Two business partners (possibly including Chamber of Commerce and/or Economic Development representatives)
- One or two university partners as appropriate

In some cases, it may also be helpful to include representatives from the following stakeholder groups:

- Workforce Investment Board
- Licensing agencies
- State department of education
- Labor organizations
- High school or college students
- Parents of high school and/or college students

THE PROCESS IN PRACTICE
Get the Right People Around the Table

In September 2005, SB 70 was chaptered into the California Education Code. The legislation established the Governor's Career Technical Education (CTE) Initiative and focused on improving linkages and career-technical pathways between high school and California community colleges ("Creating School to College Articulation," California Statewide Career Pathways, 2006, March 2010, www.statewidepathways.org/about.html). Competitive funding opportunities were disseminated to California community colleges statewide with the intent to create multiple pathway options and smooth transitions for students.

The San Diego Community College District (SDCCD) was awarded funds under the Governor's CTE Initiative and uses ongoing SB 70 grant opportunities to create a strong CTE model regionally and statewide, as demonstrated through the SDCCD CTE Community Collaborative. The exemplary model aims to provide strategic leadership from education and industry for planning, coordination, and oversight of SB 70 CTE projects awarded to the SDCCD and its partners. One of 52 California collaboratives, it is comprised of multiple partners, including community colleges, K-12 institutions, Regional Occupation Programs, and industry focused on responding to the workforce needs of the region. Projects under the collaborative have addressed industry and career technical training needs identified by the partners in a variety of industry sectors: Allied Health, Automotive, Biotechnology, Building Trades and Construction, Geographic Information Systems, and Manufacturing Engineering Technology. The projects enhance CTE for students as they acquire high-level skills and train for high-paying jobs. This is accomplished through a variety of approaches, including career exploration opportunities for middle and high school students, well-aligned dual credit career pathways, professional development opportunities for instructors from middle school to college, and funding teacher externships for secondary and postsecondary educators. Community college faculty are involved in these projects to further promote the concept of career pathways so that students may transfer seamlessly from K-12 to community college to university and/or employment. Programs continue to grow and improve as the projects cultivate and strengthen partnerships between industry and education.

Submitted by Mara Sanft
San Diego Community College District
San Diego, California

Whatever the make-up of your group, having the support of the leadership at the various partnering organizations can help overcome challenges and ensure appropriate resources for conducting this work.

Step 2: Understand the issues and challenges.

Ensuring that all participants fully understand the issues and challenges of this work is an important step in the initial phase. Once the partnership is established, a common reading of relevant research-based literature will lay the foundation for the efforts ahead. You may choose to start with "Why Significant Discussions?"(See pages 7-13.) All members of the partnership can become more familiar with challenges and opportunities that compel partners to engage in this work together. A glossary of terms (pages 52-53) defines words and phrases commonly used in education research and publications that may be unfamiliar to some partners. Worksheet B (page 16) is designed to help you and your partners clarify understanding of the issues and challenges surrounding curriculum alignment.

WORKSHEET B: Understanding the Issues and Challenges

The following questions may help you and your partners clarify and enhance understanding of the issues and challenges. You may choose to add other questions that are relevant to your partnership.

1. Describe the accountability measures at your educational level that present the greatest challenges.

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2. In your view, what is the most significant challenge students face as they progress along their educational and career pathway:

a. at the secondary level?	b. at the postsecondary level?	c. entering the workforce?

3. What role can business and industry partners play in changing these conditions?

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Step 3: Develop trusting relationships.

Develop trusting relationships where all partners are actively engaged, committed to student success, and supported by high-level leaders. If an existing partnership is in place, it may be helpful to reaffirm the purpose of the partnership, review the composition of the partnership, and revisit the conditions that call for the continuation of the work.

If a new partnership is being developed, it is critical that all partners understand:

- The circumstances that necessitate this work;
- The rationale that determines composition of the partnership;
- The role of each member of the partnership so all appreciate the experience and expertise each partner brings to the discussion; and
- The importance of establishing an environment in which all members are mutually respectful and supportive of each other, and in which every voice is equally important.

Frequent meetings will help veteran or new partnerships further develop the familiarity and trust that will assist in more timely, substantial progress and better quality results. Worksheet C (page 18) includes questions and activities to help you and your partners understand the role of building trusting relationships.

THE PROCESS IN PRACTICE
Develop Trusting Relationships

Ohio's College Tech Prep curriculum was emphasizing science, technology, engineering, and math career pathways long before the acronym STEM came into existence. Ohio's College Tech Prep provides seamless pathways for students to easily and successfully matriculate to postsecondary education through several advanced credit and articulated credit options. In 10 years, between 1994-1995 and 2004-2005, the number of high school students in Ohio College Tech Prep grew from over 600 to 13,000 in more than 800 programs.

With the oversight of 23 consortia, postsecondary Tech Prep student enrollment grew from 57 to 8,000. Ohio College Tech Prep programs are offered in engineering, teaching (science and math), computer programming, biotechnology, IT networking, interactive multimedia, marketing, business, procurement and logistics, health, criminal science, e-commerce, construction, horticulture, and auto technology.

In 2004, Ohio became part of the national Project Lead The Way (PLTW) effort, which is part of College Tech Prep. In 2005-2006, College Tech Prep adopted a teaching pedagogy grounded in business and industry with students working on problems defined by a local business and industry. This problem-based, inquiry-based initiative brings education to life, making it relevant and rigorous while building relationships among community members.

Submitted by Nick Wilson
Sinclair Community College
Dayton, Ohio

WORKSHEET C: Developing Trusting Relationships

The following questions and activities may help you and your partners clarify and enhance understanding of the issues and challenges. You may choose to add other items that are relevant to your partnership.

1. Review samples of a college placement exam. After reviewing the exam, identify the competencies that are being measured. Samples are available at http://www.act.org/compass/sample/pdf/reading.pdf and http://professionals.collegeboard.com/profdownload/accuplacer-sample-questions-for-students.pdf.

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2. As a participant in this process, you are invited to take a college placement exam. This experience may be threatening to some participants, but it can also help participants understand the challenges of incoming students who are required to take the exam. If you take the exam, it will not be graded, nor will your responses be seen by anyone without your permission and consent. During or after taking the exam, briefly describe your experience and reactions in the space below. Note that after taking the exam and engaging in discussion of the experience, you may be asked to shred your response sheet.

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3. After viewing the sample exam and/or completing the exam, take a few minutes to write your thoughts and reflections in the space below. Discuss your thoughts and reflections with other members of the group.

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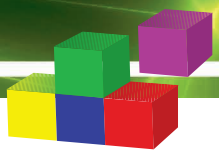

Step 4: Identify goals.

It is crucial to define and understand the scope and authority of the partnership. A functional partnership will have all the right people around the table (Step 1) to clearly identify appropriate goals necessary to lead to the intended outcomes. The partnership will also have backing and support of high-level leaders, as well as the authority to make decisions and initiate or implement appropriate action to achieve goals. Recognize that there may be minor changes in goals over time, thus requiring a change in composition of the group. Be prepared to orient new partners when necessary. Worksheet D (page 20) is designed to help you and your partners identify and clarify your goals.

MAKING CONNECTIONS

Getting Started

California Partnership for Achieving Student Success (Cal-PASS) is one example of a successful collaborative partnership. Cal-PASS Professional Learning Councils (PLCs) consist of discipline-based faculty teams from over 7,700 partner organizations. All PLC members have an equal voice as they work together to better understand barriers to successful student transitions. Councils track performance and look for ways to improve student outcomes as learners progress from elementary school through university. PLCs collaborate to discuss curriculum alignment, materials, instructional strategies, and assessment. According to Shelly Valdez, Cal-PASS Director of Regional Collaboration, the PLCs bring passionate educators together in a safe place to focus on students. Valdez noted, "We place total trust in teachers. When they are provided with time, the right data, and adequate tools, teachers make important discoveries and develop innovative solutions."

Cal-PASS is rooted in these Core Values:

- Collaboration breaks down the silos in education and creates partnerships focused on student transition and success.
- Discovery is a process of inquiry that uses data about student cohorts to understand what is happening and establish baselines about current student performance.
- Alignment creates a community where educators from each segment work with one another to align the skills, knowledge, and abilities students need to make a successful transition from segment to segment and to the world of work.
- Innovation activities empower practitioners to explore new practices that lead to improved student learning.
- Evaluation provides the opportunity to rigorously test the efficacy of new and existing practices.
- Expansion promotes the means to move from boutique practices to systemic, long-term, widespread initiatives that improve student success.

To learn more about Cal-PASS and Professional Learning Councils (PLCs),visit www.calpass.org.

WORKSHEET D: Identifying Goals

The following questions may help you and your partners clarify and enhance understanding of the issues and challenges. You may choose to add other items that are relevant to your partnership.

1. What do you believe needs to happen first to begin to change the problematic conditions outlined in "Why Significant Discussions?"

a. At the secondary level?	b. At the postsecondary level?

2. What can your partnership do to improve the most problematic conditions that exist locally?

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3. What is a realistic timeline to achieve these initial goals?

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4. How would the achievement of these goals benefit students?

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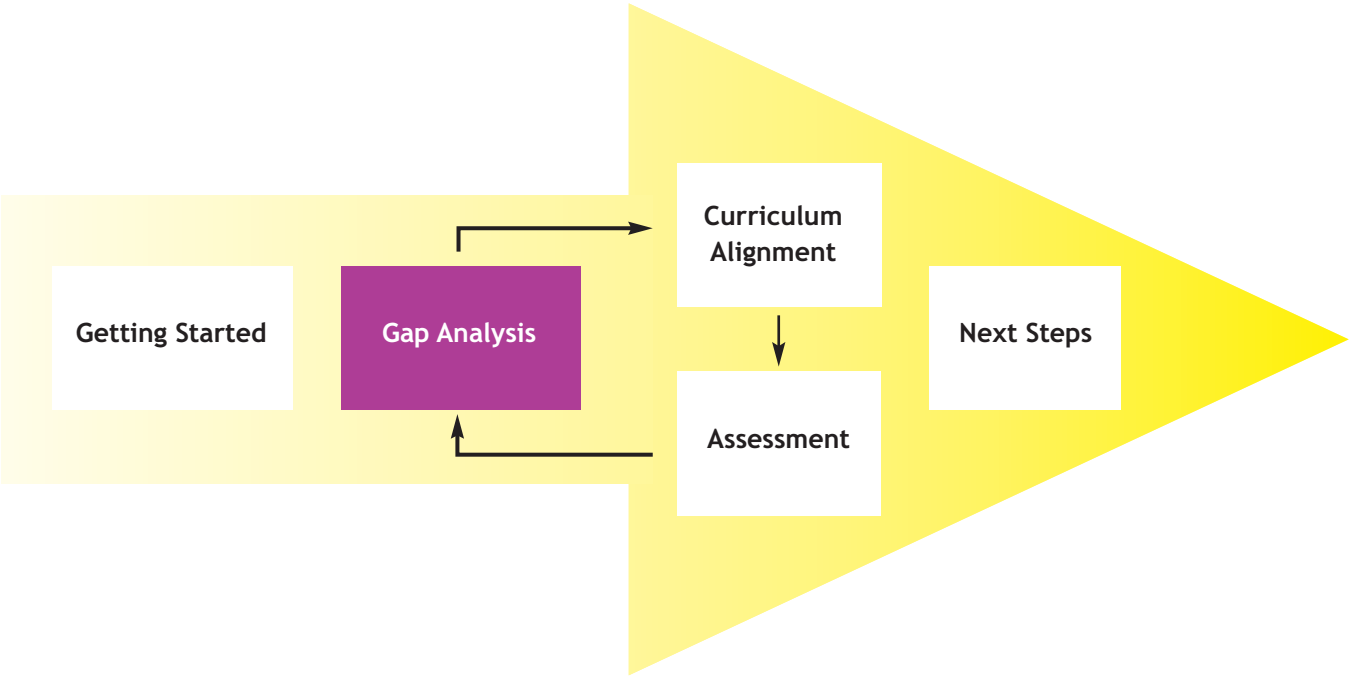


Once the collaborative partnership has been established, a gap analysis is the next phase. By definition, a gap analysis identifies gaps between the current state or condition and the future desired state. It answers the questions, "Where are we?" and "Where do we want to be?" Despite a relatively simple definition, in practice, identifying gaps between secondary and postsecondary curriculum is complicated. When considering all the facets of student success from a holistic perspective, the continuum of potential gaps can include everything from curriculum alignment to wrap-around student services. For purposes of this guide, the gap analysis focuses on gaps between the secondary and postsecondary curricula.

Step 1: Select a skilled facilitator.

Significant discussions among collaborative partnerships tend to be "unnatural" in that they are outside routine practices across educational sectors. A skilled facilitator can bring neutrality to these discussions, guarantee that all stakeholders have an equal voice, keep discussions squarely focused on solutions leading to student success, and ensure that finding fault and placing blame are not part of the conversation. Further, a facilitator can maintain the schedule and pace of meetings, keep the discussion and work moving, and limit historical accounts about what was tried or what failed in the past. In an established partnership, a trusted thought leader may serve as a facilitator. In some cases, obtaining the services of an independent facilitator to guide the gap analysis process may be advisable.

Gap Analysis Essentials

1. Select a skilled facilitator.
2. Identify the essential knowledge, skills, and/or common core standards for review.
3. Determine where and when the knowledge, skills, or core standards are delivered.
4. Determine the degree or depth of learning.
5. Identify the gaps.

As in other professional settings, members of the partnership should remain respectful and be mindful of all perspectives and points of view. The group should take deliberate steps to encourage full participation and professional conduct, and to avoid one person or organization dominating the discussion or any decision. While a skilled facilitator can help partners manage challenges and remain focused on positive solutions, the partners can also check themselves to ensure their participation is truly collaborative.

A Skilled Facilitator…

Provides the strategies and tools to establish a structured group process and help increase the effectiveness of the group.

Is attentive to details that assist in achieving the intended goals:

- identifies the primary purpose for meeting;
- schedules an appropriate meeting place;
- allows for adequate meeting time;
- invites the right people to meet;
- prepares and distributes a meeting agenda; and
- arranges for necessary supplies.

Remains neutral, promotes fairness, and doesn't advocate any specific point of view.

Ensures that everyone has an equal voice.

Assists the group in identifying and solving problems and working through the decision-making process.

Helps the group develop and adhere to ground rules and remain focused.

Assures that discussions and decisions are visibly documented.

Includes a meeting evaluation on the agenda and engages participants in evaluating the meeting.

Keeps in mind the answers to these questions:

- Do the partners know each other?
- How long has the partnership existed?
- Has the partnership previously experienced successes or challenges in working together?
- What are potential issues, if any, with this meeting?
- Can potential issues be minimized or eliminated prior to the meeting?

Sample of Ground Rules

Attend all meetings:

- Arrive on time.
- Be present for the entire scheduled meeting time.

Actively engage in discussions:

- Avoid distracting side conversations.
- Limit informal post-meeting critiques.

Stay focused:

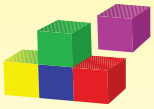
- Follow the agenda.
- Return promptly from breaks.

Show respect for the opinions of others:

- Everyone deserves an equal voice.
- Give credit to others when it is due them.

Ask questions and respect the questions of others:

- If you wonder, ask.
- Support others' learning.



Step 2: Identify the essential knowledge, skills, and/or common core standards for review.

The next step in the gap analysis is to identify the critical knowledge and skill elements in the various curricula. Consider consulting, for example, the States' Career Cluster Initiative Knowledge and Skill Statements (www.careerclusters.org), the Common Core State Standards (www.corestandards.org), individual state standards, and discipline-specific and industry-based standards as defined by licensing or professional organizations.

The States' Career Cluster Initiative Knowledge and Skill Statements are used widely in developing programs of study. They were identified in partnership with the League for Innovation's College & Career Transitions Initiative, states, schools, educators, employers, industry groups, other stakeholders, and the States' Career Clusters Initiative. The Essential Knowledge and Skill Statements specify the knowledge and skills that are critical for success in any career. Career Cluster Knowledge and Skill Statements exist for 16 career clusters and 79 career pathways that represent all career possibilities. They are organized into ten categories (see box, below) with numerous performance elements within each category.

Knowledge and Skill Categories

- Academic Foundations
- Communications
- Problem Solving and Critical Thinking
- Information Technology Applications
- Systems
- Safety, Health, and Environmental
- Leadership and Teamwork
- Ethics and Legal Responsibility
- Employability and Career Development
- Technical Skills

Academic content standards are foundational to all knowledge and skill statements across every career. Essential Knowledge and Skill Statements identify knowledge and skills that are universal, while more specific career cluster knowledge and skill statements exist for each of the 16 career clusters. All the statements include academic standards. See Appendix A-1 for a complete list of Essential Knowledge and Skill Statements.

In the gap analysis, you and your partners should also consider the common core state standards. The Common Core State Standards Initiative (www.corestandards.org) has established common national standards in mathematics and language arts. Partners may consider these relevant core standards along with the essential and career cluster knowledge and skill elements. Each of the common core language arts and math standards offers illustrated examples, cites the research basis for the standard, shows alignment with state and other standards, and provides benchmarks against high-performing nations. Math and language arts literacy are central to every course, every discipline, and every career pathway; therefore, it is the responsibility of all instructors to embed college-ready standards in the high school curriculum to help prepare students for entry into college-level courses. Considering that deficiencies in math and language arts are the primary reason recent high school graduates are placed in remedial courses, this focus becomes even more critical.

Use your partnership's existing curriculum maps or pacing guides in the gap analysis. Curriculum maps and pacing guides are described in more depth in the "Curriculum Alignment" section, pages 32-39. The gap analysis may provide a good time to map or crosswalk the various elements with existing program, departmental, state, or institutional learning outcomes. Doing so will save time and maintain consistency. The completed gap analysis will be used throughout Steps 3 through 5. Worksheet E (pages 24-25) provides a gap analysis template you and your partners may wish to use during these steps.

For example . . .

- See Appendix A-2 for a sample of the Education and Training Career Cluster Knowledge and Skill Statement used by Anne Arundel Community College in its gap analysis.
- See Appendix A-4 for a sample of the Information Technology Career Cluster Knowledge and Skill Statement used by Corning Community College in its gap analysis.

WORKSHEET E: Gap Analysis Template

Cluster Knowledge and Skill Statements

	High School	2-Year College	4-Year College	NOTES:
Academic Foundations				

	High School	2-Year College	4-Year College	NOTES:
Communications				

	High School	2-Year College	4-Year College	NOTES:
Problem Solving and Critical Thinking				

	High School	2-Year College	4-Year College	NOTES:
Information Technology Applications				

	High School	2-Year College	4-Year College	NOTES:
Systems				

Symbol Legend

+ Included in curriculum
✔ Minor coverage in curriculum
– Absent from the curriculum

Cluster Knowledge and Skill Statements

	High School	2-Year College	4-Year College	NOTES:
Safety, Health, and Environmental				

	High School	2-Year College	4-Year College	NOTES:
Leadership and Teamwork				

	High School	2-Year College	4-Year College	NOTES:
Ethics and Legal Responsibilities				

	High School	2-Year College	4-Year College	NOTES:
Employability and Career Development				

	High School	2-Year College	4-Year College	NOTES:
Technical Skills				

Symbol Legend

+ Included in curriculum
✔ Minor coverage in curriculum
– Absent from the curriculum

Step 3: Determine where and when the knowledge, skills, or core standards are delivered.

Once the partners reach consensus on the relevant knowledge and skill expectations and core standards, the next step is to determine when and where students learn the knowledge, skill, or standard. Thorough review will determine whether the knowledge, skill, or standard is taught in the high school or at the community college.

The partnership may choose from among various ways in which to identify the presence or absence of elements within the curriculum. The box to the right offers two examples.

For example . . .

- One way to identify and evaluate elements:
  - \+ Included in curriculum
  - ✔ Minor coverage in curriculum
  - \- Absent from the curriculum
- Another way to identify and evaluate elements:
  - 4 Exceeds criteria and/or able to understand and teach task
  - 3 Accomplishes task to meet criteria
  - 2 Accomplishes task with help
  - 1 Exposed to the task
  - N Not exposed to task

THE PROCESS IN PRACTICE
Determine Where and When the Knowledge, Skills, or Core Standards Are Delivered

Tillamook Bay Community College has a partnership with Tillamook High School to share a facility with Career and Technical Education (CTE) classes and activities. The college also partners with several local high school hospitality programs.

At Lane Community College (LCC), the Regional Technical Education Consortium (RTEC) program offers career and technical courses not available at area high schools, and other programs are located on participating high school campuses. Some school districts will help pay for courses located on LCC campuses.

Southwestern Oregon Community College (SWOCC) has launched an Enhanced Options program to extend credit-bearing opportunities to district high schools. In addition to College Now courses offered for college credit at the high schools and taught by qualified high school instructors, the college extends college faculty into the high schools to deliver college courses. Additionally, the college will pilot an online college course that conforms to the high school calendar and that will provide opportunities to the smaller rural high schools. Other SWOCC programs are described below.

- An annual Counselors Day provides an opportunity for secondary counselors in the region to become acquainted with SWOCC initiatives, policies, and collaborations.
- An annual College 101 event allows high school juniors to experience a half-day of college classes and become familiar with the college campus. Students are encouraged to select courses in their areas of interest.
- A summer culinary camp at the Oregon Coast Culinary Institute, "Cooking up a Storm," is for high school students 16 years and older who are interested in exploring the culinary and hospitality industry.

Submitted by Diana Schab
Southwestern Oregon Community College
Coos Bay, Oregon

Step 4: Determine the degree or depth of learning.

After you and your partners have determined when and where students learn the knowledge, skills, or standards, you may choose to gauge the depth or degree to which the education provider—high school or community college—is teaching each element.

The Rigor/Relevance Framework is a tool that provides a visual representation and common language for the knowledge, skills, and abilities business leaders and educators agree students should learn. The framework gives educators some structure to use in developing curriculum and assessment instruments.

The knowledge dimensions include:

Knowledge, which "involves the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting."

Comprehension, which "refers to a type of understanding or apprehension such that the individual knows what is being communicated and can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications."

Application, which refers to the "use of abstractions in particular and concrete situations."

Analysis, which represents the "breakdown of a communication into its constituent elements or parts such that the relative hierarchy of ideas is made clear and/or the relations between ideas expressed are made explicit."

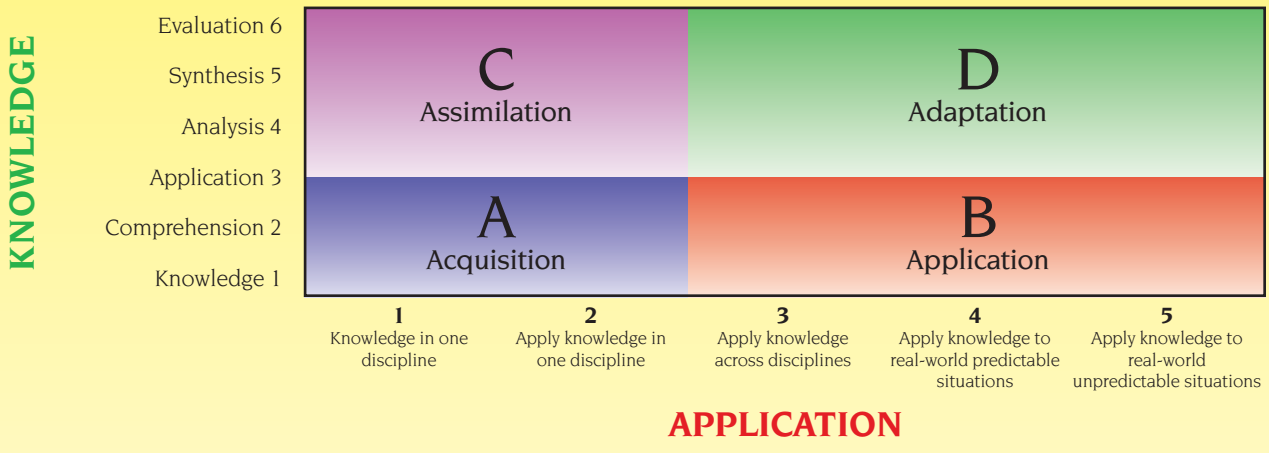
Synthesis, which involves the "putting together of elements and parts so as to form a whole."

Evaluation, which engenders "judgments about the value of material and methods for given purposes."

Compiled from Bloom et al., *Taxonomy of Educational Objectives* (*Handbook One*, pp. 201-207), as cited in Vanderbilt University Center for Teaching and Learning, "Bloom's Taxonomy," http://cft.vanderbilt.edu/teaching-guides/pedagogical/blooms-taxonomy/.

The framework integrates the application dimensions resulting in four quadrants, listed below. For a graphic representation, see Rigor/Relevance Framework, below.

Rigor/Relevance Framework



The Rigor/Relevance Framework was developed by staff at the International Center for Leadership in Education (www.LeaderEd.com). The knowledge dimension (the vertical axis) incorporates the six levels of Bloom's Taxonomy and describes the increasingly complex ways that learners think. The application dimension (the horizontal axis) was developed by William R. Daggett. The five application levels range from acquiring knowledge to using knowledge to solve complex real-world problems.

Quadrant A, Acquisition, represents simple recall and basic understanding of knowledge.
Quadrant C, Assimilation, represents more complex and higher order thinking.
Quadrant B, Application, represents action and degree of application including knowing how to use knowledge.
Quadrant D, Adaptation, represents action and a higher degree of application including the ability to gather knowledge from multiple sources, evaluate, and use that information to solve complex problems.

Compiled from information retrieved at http://www.leadered.com/rrr.html.

Optimal learning occurs in Quadrant D when students apply interdisciplinary knowledge in real-world situations. Business, industry, and labor partners can assist in designing these learning experiences and validating competencies as essential or required in the workplace. This comprehensive approach details the depth to which the concepts are covered in the high school or college classroom and the relevance of the knowledge or skill in workplace application.

For example . . .

Ohio Competency Charts (Appendix A-6) indicate whether secondary and postsecondary partners introduce, reinforce, or expect proficiency of various competencies. Business, industry, and labor partners code competencies as essential or required.

Step 5: Identify the gaps.

Curriculum review exposes gaps and identifies whether essential knowledge and skills are present or missing along the continuum. Completing the gap analysis is a vital step to guiding curriculum alignment work going forward.

Curriculum review will identify gaps as well as duplications. Two examples of gap analysis (see box, at right) illustrate that partners selected some, though not all, elements from the Career Cluster Knowledge and Skill Statements. Like Anne Arundel and Corning Community Colleges, you and your partners will make these decisions based on your local needs. Business and industry partners can provide vital input during this phase as they have local, practical, and functional knowledge of the academic and technical proficiencies needed to be successful in the workplace.

When the gap analysis is complete, convene partners to review the results from various individual perspectives. Each partner should check for any issues or concerns specifically related to his or her interests in and contributions to the curriculum continuum. Worksheet F (page 30) is designed to help you and your partners identify curriculum gaps and begin to consider strategies that will be more fully developed in the Curriculum Alignment phase.

Following a thorough review, check for general agreement among the partners. Are there concerns or issues that need special attention before moving forward? If so, have the group determine the best approach or corrective action and the partner or partners who will be responsible for revisions.

If concerns or issues persist, try to work toward consensus or compromise. This review is not a one-time event. Gap analysis and curriculum revision are phases of the ongoing continuous improvement cycle. Whenever feasible, the most critical and highest priority gaps should be identified and corrected first. Considering limited resources, it is unlikely that all gaps identified in the analysis can be eliminated immediately. Persistent gaps can be mitigated in the short term and addressed more fully in subsequent review and revision cycles.

For example . . .

- A sample of the Anne Arundel Community College Education and Training gap analysis is found in Appendix A-3.
- A sample of the Corning Community College Information Technology gap analysis is found in Appendix A-5.

When the gap analysis, or revised gap analysis, meets approval of the participating partner representatives, disseminate it to the full partnership for review. The full partnership may include business partners, administrators, or faculty who were not directly involved in completing or reviewing the gap analysis. Now is the time to solicit their input.

One cautionary note: It is important to recognize the possible impact of the gap analysis information on the collaborative partnership. Maintaining a respectful and supportive relationship is crucial even if the gap analysis delivers disappointing results. This is a point in the process at which a skilled facilitator can help the partners remain focused on student success and ensure that finding fault and placing blame are not part of the conversation.

THE PROCESS IN PRACTICE
Identification of Gaps

Greater Phoenix has long been home to a broad and diverse technology base in aerospace, aviation, electronics, and information technology. The region has recently made substantial investments in emerging high-tech fields such as bioscience, sustainability, and solar applications. However, a key to the long-term growth and success of these industries will be the region's ability to provide a steady supply of skilled and knowledgeable technicians.

Increasing the supply of technicians is critical to improving the region's economic competitiveness, as is fortifying the educational system's capacity to provide just-in-time new programs as industry needs evolve. The fast-changing pace of technology and industry's application of these technologies can very quickly result in curriculum being thrown out of sync with the critical skill sets needed by industry.

To bolster the educational system's capacity to respond more rapidly to industry needs, Maricopa's "High Tech Workforce Initiative 2.0 Externship-Driven Talent Development" project offers secondary and postsecondary faculty access to organizations that can provide comprehensive exposure to technologies that are in the pre-adoption or early industry adoption stage and that are germane to the local economy.

These joint industry-based faculty externships provide the framework for ongoing collaboration between secondary and postsecondary faculty. The comprehensive alignment of curriculum is more likely to occur in an environment where secondary and postsecondary faculty members are working as a team with full knowledge and agreement of the planned competencies to be taught in their respective classes. The end result of this cooperation is a smoother and more seamless transition of high school students into the community college system.

Submitted by Richard Hansen
Maricopa Community Colleges
Phoenix, Arizona

WORKSHEET F: Identifying Gaps

The following questions and activities may help you and your partners identify curriculum gaps and begin to consider strategies that will be more fully developed in the Curriculum Alignment phase.

1. Review the gap analysis from an overall perspective. Has anything been omitted or misplaced?

_____

_____

_____

2. Check for agreement among participants. Do all partners generally agree with the results of the gap analysis? If not, what are the areas of disagreement?

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3. Check for agreement among other stakeholders (e.g., additional faculty and business partners not actively participating in the gap analysis). Identify areas of disagreement.

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4. Where disagreement exists, what steps can be taken to work toward consensus?

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5. Review the gap analysis and prioritize the gaps from most to least critical.

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MAKING CONNECTIONS

Gap Analysis

The Significant Discussions guide can be a useful complement to the Common Core State Standards Initiative (www.corestandards.org). "It struck us that other countries that have national curriculums have advantages over us," said Scott Montgomery, deputy executive director of the Council of Chief State School Officers (CCSSO). CCSSO and the National Governor's Association are leading the Common Core State Standards Initiative in 48 states, two territories, and the District of Columbia. The goal of the Common Core State Standards Initiative is to coordinate state-led efforts to design standards that seamlessly connect high school curriculum to college admissions and placement policies so that young people are truly ready for college, ready for careers, and ready for success in the global economy. According to Kati Haycock (qtd. In Lederman, 2009) of the Education Trust, "This is the first time the K-12 people have stood up and said, 'College readiness is our goal.' Higher ed people ought not to underestimate how big a deal this is."

Educators and policymakers agree about the need to better align K-12 and higher education so that students coming out of high school have the skills and knowledge to do college-level work and have little or no need for remediation while in college. In "Ticket to Nowhere" (Haycock et al., 1999, p. 5), the authors point out that, "For [common] standards they must faithfully and firmly represent the knowledge and skills necessary to successfully begin work at the next educational level."

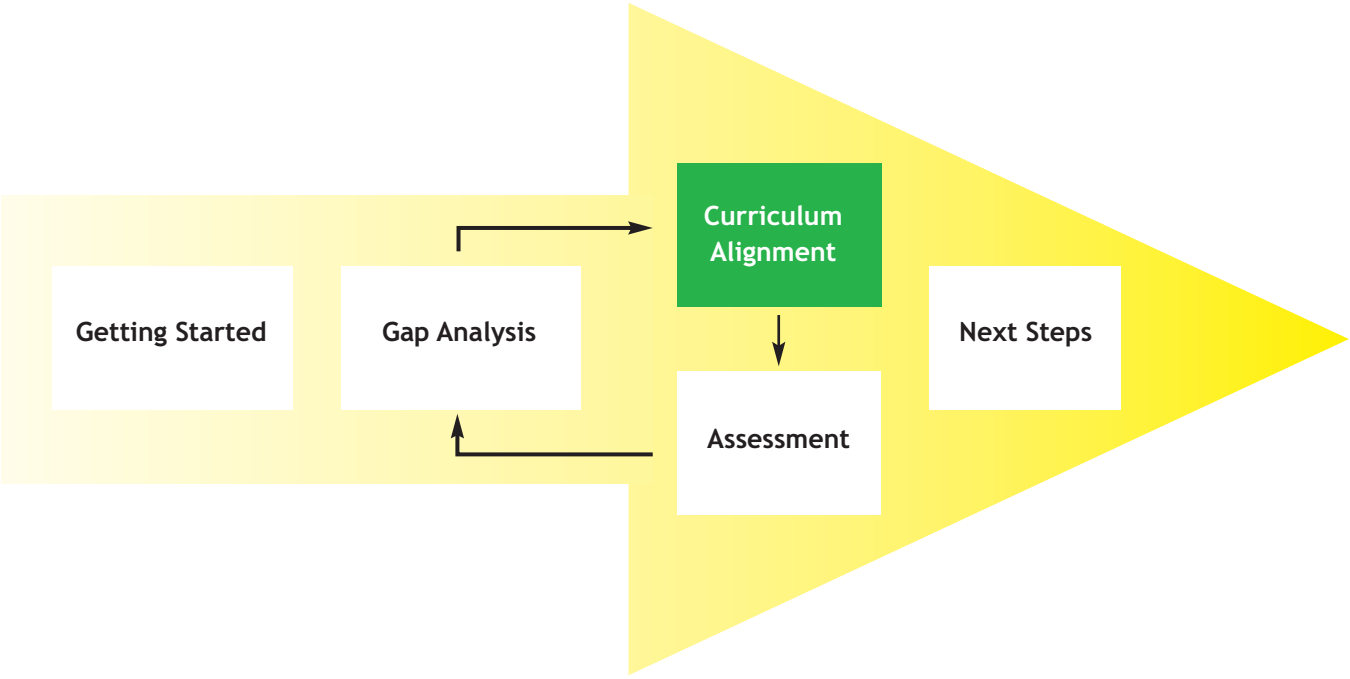
The Common Core Standards have the following general characteristics:

- They are aligned with college and work expectations.
- They are clear, understandable, and consistent.
- They include rigorous content and application of knowledge through high-order skills.
- They build upon strengths and lessons of current state standards.
- They are informed by other top-performing countries, so that all students are prepared to succeed in our global economy and society.
- They are based on evidence and research.

The process of aligning secondary and postsecondary academic standards requires substantial collaboration between higher education, state education agencies, school district leaders, and the business community (Bottoms and Young, 2008). The business community must be deeply involved in order to ensure that the resulting standards reflect their expectations and are accepted by them. No single group can do this work alone; its size and complexity compel collaboration.

The authors of *Out of Many, One* (Achieve, Inc., 2008a, p. 21) content that "True progress will come from a shared commitment and sustained attention of leaders in each sector." The Common Core Standards have been developed collaboratively with various stakeholders, including content experts, teachers, administrators, and parents. The Common Core Standards will give students equal access to a quality education regardless of where they live. This is particularly critical with increased student mobility across the nation.

Compiled from information retrieved at www.corestandards.org. To learn more about the Common Core State Standards Initiative, visit www.corestandards.org.



When the gap analysis is complete, the next phase in the process is curriculum alignment. Curriculum alignment, or curriculum mapping, within a K-12 system is a significant undertaking. Curriculum alignment across secondary and postsecondary education systems can seem like a daunting task, but it must be accomplished in order to truly align systems that support smooth student transitions.

Curriculum Alignment Essentials

1. Identify the points in the curriculum to introduce or reinforce knowledge, skills, or core standards.
2. Identify the resources necessary to integrate the knowledge, skills, or core standards into the sequence of instruction.
3. Determine effective strategies to assess student acquisition of the knowledge, skills, or core standards.
4. Review regularly for continuous improvement.

Currently, the K-12 standards are not connected with higher education. The authors of *Raising Our Sights: No High School Senior Left Behind* (Woodrow Wilson National Fellowship Foundation, 2001, p. 23) explain that, "The simple truth is that K-12 systems cannot align their curricula and standards with postsecondary education and work unless both of these systems are much clearer about the core reading, writing, and mathematics skills students need to succeed. Corporations and postsecondary institutions must become active partners in the alignment effort." The collaborative work among schools, colleges, and business partners is a first step in redesigning current structures and practices to develop systemic approaches that link educational sectors and better ensure successful student transitions (Callan et al., 2006; Venezia, Kirst, and Antonio, 2004). The *Raising Our Sights* (p. 22) authors note that, "Lack of alignment between the curriculum, standards, and assessment systems of K-12 and postsecondary education means that students find themselves poorly prepared for postsecondary education and work." In *Claiming Common Ground* (2006, page 2), Callan et al. suggest that "states should require K-12 and postsecondary education to align courses and assessments."

For example . . .

A sample of Bartholomew Consolidated School Corporation (IN) Grade 8-12 Language Arts Spiraling Standards is found in Appendix B-1.

The different ways in which K-12 and higher education systems structure curriculum is certainly a contributing

factor to current lack of connection and alignment. K-12 systems are generally organized by grade level and content-area standards established by individual state departments of education. Curriculum maps help identify when, where, and how the skills and knowledge linked to those standards are embedded into the K-12 curriculum. Content is repeatedly reviewed and reinforced, builds on previous knowledge, and becomes increasingly complex and sophisticated over time.

Curriculum in higher education is generally organized differently than it is in K-12 systems. Rather than aligning to state standards, curriculum in higher education is more likely to be designed to meet course objectives or learning outcomes for the division or institution. In many cases, a series of course objectives may culminate in a certification or licensing exam. Consequently, course objectives include the knowledge and skills necessary to successfully complete the certification or licensing exam.

Step 1: Identify the points in the curriculum to introduce or reinforce knowledge, skills, or core standards.

Using your partnership's existing curriculum maps or pacing guides, consider when and how key content and skills are delivered and assessed. Well-developed curriculum maps unpack or unwrap the standards to detail the sequence of classroom instruction, activities, and assignments that address elements of various standards.

Pacing guides can be another useful tool to align or map curriculum and sequence the delivery of content. Pacing guides outline when and how concepts, topics, and skills are addressed during a particular class or curriculum.

For example . . .
A sample of Miami Dade County Public Schools (FL) 12th Grade English Pacing Guide is found in Appendix B-3.

Although few tools are available to assist in detailed curriculum mapping across educational systems, an effective model from Sinclair Community College (Appendix B-4) uses pacing guides to map K-12 curriculum and link it to the appropriate college courses. This pacing guide was developed collaboratively by a group of individuals including a curriculum consultant and secondary and postsecondary faculty. The development process involved extensive discussion about state secondary standards, scope and sequence of instruction, and connections to postsecondary curriculum. In Appendix B-4, the PCTC/SCC pacing guides document the particular knowledge and skills addressed and lists instructional resources. These guides show content alignment with college courses and are particularly useful when preparing dual credit or articulation agreements.

THE PROCESS IN PRACTICE
Curriculum Alignment

Demand for qualified, highly-trained engineers in the United States is on the rise. According to the Bureau of Labor Statistics, some of the fastest-growing occupations through 2014 will be related to engineering, and the Charlotte-Mecklenburg school system is ready for the challenge. Four Charlotte-Mecklenburg high schools have opened Academies of Engineering and three others will open soon. The schools will be among only 110 high schools in the country with the approved Academy of Engineering program. The Academy of Engineering initiative is a collaboration between the National Academy Foundation (NAF), Project Lead The Way, and the National Action Council for Minorities in Engineering (NACME). These Academies of Engineering supplement the existing 18 Project Lead The Way high schools and more than 3,000 pre-engineering students enrolled in the district. This partnership, through a new Engineering Academy at Central Piedmont Community College, provides a rigorous and relevant curriculum that will allow students to leave high school ready for college and to leave college ready for careers.

Submitted by Chad Ray
Central Piedmont Community College
Charlotte, North Carolina

THE PROCESS IN PRACTICE
Curriculum Alignment

Maryland redesigned its system of Career and Technology Education (CTE) a dozen years ago to prepare students for the 21st century's global economy and its rapidly changing workforce needs. With over 350 business and industry representatives, Maryland established a Career Cluster Framework organized by broad industry and economic sectors. Maryland's career clusters guide the development of CTE programs of study that emphasize problem-solving and critical thinking, rather than narrow, procedural knowledge. The clusters help connect educators and employers and provide a framework for responsive, well-articulated workforce development.

Maryland's CTE programs of study integrate challenging academic and career and technical instruction—better linking secondary and postsecondary programs—and support strategic partnerships among high schools, colleges, and business and industry. For a list of Maryland's CTE programs of study, visit the MSDE website at www.marylandpublicschools.org/MSDE/divisions/careertech/career_technology/programs/ .

The Maryland State Department of Education (MSDE) encourages school systems to adopt its CTE programs of study. The Maryland CTE programs of study were developed with higher education, government, industry, and labor, and allow students to take advantage of articulation agreements with several of the state's two- and four-year colleges. MSDE supports the state programs of study through implementation grants, statewide professional development, and professional learning communities.

Submitted by Kathleen Beauman
Anne Arundel Community College
Baltimore, Maryland

For example . . .

A sample of the Ponitz Career and Technical Center/Sinclair Community College Biotechnology (11th and 12th grades) Year-long Pacing Guides are found in Appendix B-4.

Step 2: Identify the resources necessary to integrate the knowledge, skills, or core standards into the sequence of instruction.

Some curriculum gaps may be corrected with only minor revisions. Other curriculum gaps may require the acquisition or expenditure of resources. Perhaps additional or different textbooks are needed to teach or reinforce knowledge, skills, or standards. Perhaps only expendable workbooks are necessary. The gap analysis may have uncovered the need for some technical assistance or the realization that a teacher externship would help to better infuse real-world experiences into the curriculum. Additional or redesigned spaces may be needed in order to provide learning opportunities for students. Your partnership may have other requirements that will help to close curriculum gaps. Worksheet G (pages 35-36) is designed to help you and your partners identify resources for use in bridging curriculum gaps.

Necessary resources may exist within the department or institution, or business partners may be able to provide some resources such as equipment, supplies, materials, or expertise. In some cases, additional resources needed to close curriculum gaps might require budget consideration. The tables in Worksheet G may help your partnership think about the resources you need to close identified gaps.

WORKSHEET G: Identifying Resources

WORKSHEET

1. Consider equipment and supplies necessary to bridge curriculum gaps.

Equipment and Supplies	Critical	Helpful	Wish List	Estimated Cost
Durable equipment				
Textbooks				
Expendable materials				
Supplies				
Teaching tools				

2. Consider education and training necessary to bridge curriculum gaps.

Education and Training	Critical	Helpful	Wish List	Estimated Cost
Professional development				
Technical assistance				
Business consultation				
Teacher externships				
Student internships/co-op				

3. Consider resource requirements necessary to bridge curriculum gaps.

Resource Requirements	Critical	Helpful	Wish List	Estimated Cost
New or redesigned space				
Personnel				
Contract expertise				
Operating funds				
Licensing costs				

4. Consider other necessary resources to bridge curriculum gaps.

Other	Critical	Helpful	Wish List	Estimated Cost

Step 3: Determine effective strategies to assess student acquisition of the knowledge, skills, or core standards.

The gap analysis identifies curriculum gaps. Curriculum alignment and revision work strives to close those gaps. These efforts are not complete until an assessment instrument is designed or modified to evaluate whether the knowledge or skill was acquired. Learning experiences should be developed and embedded in the curriculum with the eventual learning outcome in mind. The assessment is then integrated into the curriculum map or pacing guide to assess the knowledge, skill, or standard that was missing from the continuum.

You may want to consider an assessment instrument that is consistent with the format and spirit of existing assessments. Consider using or designing authentic assessments that offer students various ways to demonstrate what they know and can do.

Suggested reading on assessment

Trudy Banta
- *Building a Scholarship of Assessment*
- *Hallmarks of Effective Outcomes Assessment*
- *Designing Effective Assessment: Principles and Profiles of Good Practice*

Marcia Mentkowski
- *Learning That Lasts: Integrating Learning, Development, and Performance in College and Beyond*

W. James Popham
- *Assessment for Educational Leaders*
- *Classroom Assessment: What Teachers Need to Know*

Ruth Stiehl
- *The OUTCOMES Primer: Reconstructing the College Curriculum*
- *The ASSESSMENT Primer: Creating a Flow of Learning Evidence*

Grant Wiggins
- *Understanding by Design*
- *Educative Assessment: Designing Assessments to Inform and Improve Student Performance*

THE PROCESS IN PRACTICE
Curriculum Alignment

The Missouri Tech Prep Consortiums have piloted programs of study using the Career Cluster framework. The program of study projects resulted in curricula that align secondary and postsecondary elements; include academic and Career and Technical Education (CTE) content; and lead to an industry-recognized credential or certificate at the postsecondary level and/or an associate's degree.

The development of programs of study is a collaborative effort among schools and colleges to seamlessly coordinate classroom instruction and support experiences and activities for a particular career cluster or pathway. The programs of study also include career and technical student organizations, career development and guidance, and community participation. They are built upon curriculum that addresses cluster and pathway knowledge and skills, as well as national and state academic standards.

Missouri is also a partner in the Project Lead The Way (PLTW) initiative. Project Lead The Way is a curriculum that helps students use technology and mathematics to solve problems, understand and apply the scientific process, understand technology systems, and work in teams. The ultimate goal is to prepare the students for college engineering courses. The Project Lead The Way curriculum enhances and expands technical education in high schools, encouraging students to explore engineering and technical career fields and to identify and pursue academic prerequisites for college engineering programs. PLTW activities include opportunities for field trips, internships, and summer jobs.

Submitted by Casey Shiller
St. Louis Community College
St. Louis, Missouri

Step 4: Review regularly for continuous improvement.

Institutions should consider developing processes and procedures that ensure opportunities for ongoing communication and evaluation. Gap analysis and curriculum alignment review and revision should be a dynamic part of the continuous improvement process. Assessment results and other data available to the partners will help to inform the revision process. The Roundtable Review hosted by the collaborative partnership at Sinclair Community College in Dayton, Ohio, is an effective continuous improvement model. This provides an opportunity for all stakeholders to come together regularly with a focus on examination of student learning goals and outcomes.

Curriculum review is an important step when renewing dual credit or articulation agreements; however, successful partnerships meet more often than is necessary for a single annual review of such agreements. Frequently scheduled partnership meetings help build and strengthen relationships; provide an opportunity to maintain focus on the curriculum through analysis of data; and provide a venue for updates on emerging trends, policy changes, and institutional or organizational changes.

THE PROCESS IN PRACTICE
Curriculum Alignment

Established in 2008, the Miami-Dade Career Pathways Consortium (CPC) is a partnership between Miami Dade College (MDC) and Miami-Dade County Public Schools (M-DCPS) that is committed to increasing student success. The majority of M-DCPS students begin their postsecondary journey at MDC, and for many, the college's open enrollment policy is the only opportunity to acquire a postsecondary education. Objectives of the CPC are to

- Expand and promote Career Pathways Programs of Study to assist students to transition from secondary to postsecondary education and into careers.
- Develop and implement comprehensive articulation agreements for students enrolled in their respective school districts and service areas.
- Provide greater opportunities for students to participate in advanced level courses.

The CPC produces the Student and Adult Career Pathways EXPO annually, showcasing career and technical education and professional opportunities. This event was recently awarded the 2010 National Association for Tech Prep Leadership (NATPL) Promotion of Tech Prep/Career Pathways National Award.

The CPC develops local articulation agreements awarding college credit to students for secondary and postsecondary program performance. These local agreements complement the Statewide Career and Technical Education Articulation Agreements approved by the Florida Board of Education. Both the local and the statewide articulation agreements award college credits to students completing postsecondary adult vocational (PSAV) programs or earning industry certification.

MDC and M-DCPS serve on the South Florida Workforce (SFW) Investment Board, which manages all Workforce Investment Act (WIA) funding streams intended to raise the level of productivity of the local workforce. In partnership with SFW, MDC and M-DCPS play active roles in identifying the high-skill, high-wage, and high-demand occupations guiding the development of Career Pathways and Programs of Study. Additionally, a representative from SFW serves on the CPC Steering Committee.

Submitted by Donna Jennings
Miami Dade College
Miami, Florida

MAKING CONNECTIONS

Curriculum Alignment

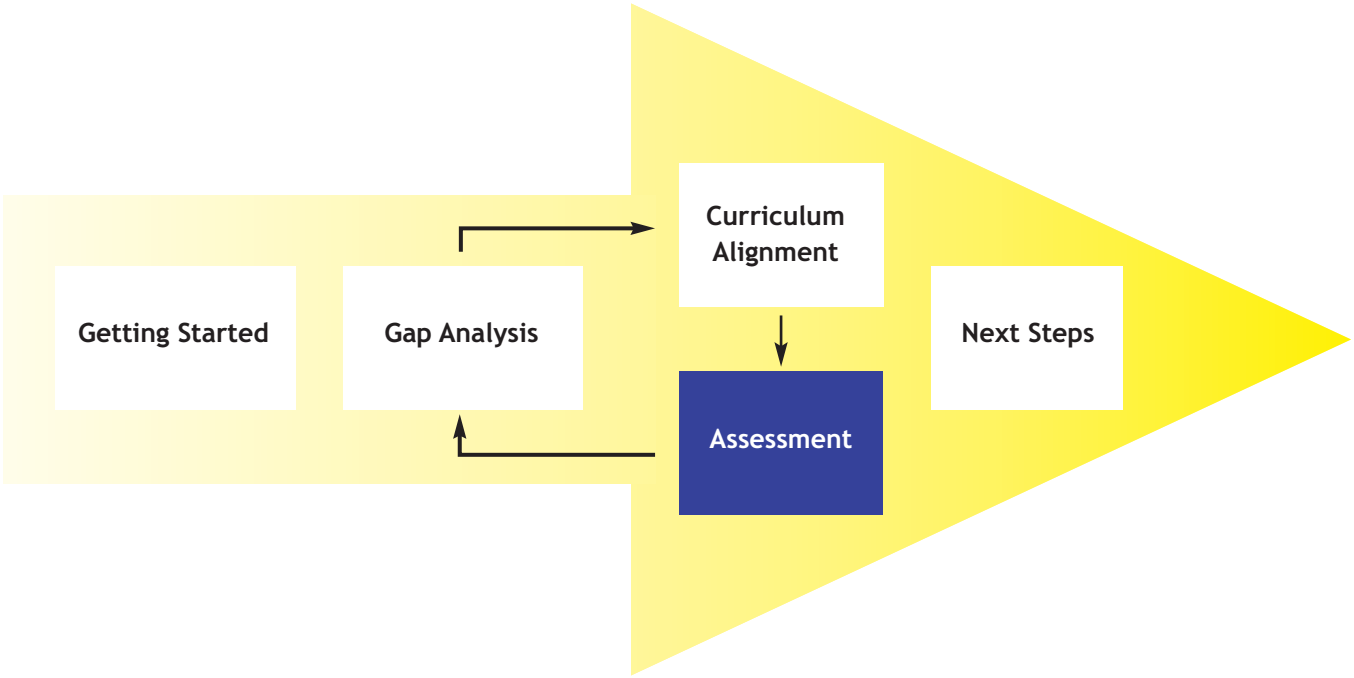
Aligning Curricula and Career Education for Student Success (ACCESS) is an initiative of the California Partnership for Achieving Student Success (Cal-PASS). The goal of ACCESS is to align curricula sequentially, using exit and entrance competencies, from 11th grade through transfer-level postsecondary coursework.

The ACCESS work thus far confirms the challenges in attempting to knit K-12 state standards into appropriate entry points of college-level courses. Groups of language arts and math teachers collaborate to organize materials for each content area and establish sequencing or pacing templates. The ACCESS work groups crosswalk the competencies with California state standards and with the evolving Common Core Standards.

Eden Dahlstrom, ACCESS project director, notes, "Teachers were not widely involved in developing the early drafts of the Common Core Standards, yet we found substantial overlap between these standards and exit competencies developed by current college and classroom faculty and practitioners for the same coursework." ACCESS work groups go further and actively collaborate with Career and Technical Education (CTE) Ambassadors to identify CTE connections within the curricula.

Once the ACCESS work is complete, the resulting guidebooks for 11th grade through transfer-level coursework will be an innovative example of professional learning councils collaborating to integrate academic content with CTE content in an aligned and contextualized format.

To learn more about Cal-PASS, ACCESS, and Professional Learning Councils (PLCs), visit www.calpass.org.



After the gap analysis and curriculum alignment work is complete, the next phase is assessing whether this work has resulted in the intended outcome: to help students transition from secondary to postsecondary education without the need for remediation. Contributors to this guide have engaged in significant discussions and aligned secondary and postsecondary curriculum. In this section, they offer their advice on assessing the effectiveness of curriculum alignment.

Assessment Essentials

1. Determine the most effective strategies to validate curriculum alignment.
2. Design an assessment process that will deliver results.
3. Analyze the results of the assessment.
4. Review and act on the analysis of assessment outcomes.

Step 1: Determine the most effective strategies to validate curriculum alignment.

A number of strategies, including exchanges and data analysis, can be used to validate curriculum alignment. Determining which strategies to use, whether those presented here or others that better meet the needs of your partnership, is the first step of the assessment process.

Exchanges. Many students across the country exchange and evaluate each others' work, and educators can do the same. Partners can exchange lessons, units, assessment instruments, and even personnel to help determine whether, or how effectively, the curriculum aligns across educational levels.

College entrance competencies confirmed at high school exit. In this exchange, college faculty members provide beginning lessons or units to their high school counterparts. To maintain the security of college assessment instruments, they share lessons or units rather than exams. Secondary teachers deliver these lessons or units in the final phases of the capstone class. Together, secondary and postsecondary teachers can assess whether students nearing completion of the secondary class or sequence of courses are prepared to handle the material contained in the beginning stages of the college-level course. If high school students struggle with the material, postsecondary and secondary educators then work together to identify the missing knowledge or skill and determine when and where to include the information in the curriculum.

High school exit exams tested at the college. In this exchange, secondary teachers provide end-of-course or capstone exams to their counterparts at the college. College faculty members administer these

assessments to their students in the beginning stages of the college-level course or program of study. College faculty can assess whether students beginning their courses possess the competencies that will enable them to succeed in the college course or career pathway. If there are gaps, secondary and postsecondary educators work together to indentify the missing knowledge or skill and determine when and where to include the information in the curriculum. They revise the curriculum accordingly.

Faculty exchange. Even more powerful than exchanging lessons, units, and assessment instruments, personnel exchanges provide high school faculty, college faculty, and business partners a first-hand experience in fully understanding and appreciating each other's worlds. In this scenario, secondary and postsecondary faculty members personally participate in confirming the alignment by exchanging roles for a set period of time, and cross-institutional relationships are strengthened in the process. High school and college faculty can also participate in shared professional development that facilitates increased knowledge of college expectations and enhances relationships. Students ultimately benefit from this and other forms of exchange.

Assessment Tips

When high school end-of-course or capstone exams are given to college students early in the term as a tool to assess curriculum alignment, consider only competencies for pipeline students from partnering high schools. Some students will enter the college course from other institutions or life experiences, and their performance does not accurately represent the effectiveness of the partnership's work.

Further, when considering certification scores as a tool to assess the effectiveness of the collaborative work, consider only scores for students who came through the partnership pathway.

Finally, when analyzing the data, consider only scores for pipeline students from partner high schools or career centers to identify deficiency trends.

Business partner participation. Involving business and industry partners in the exchange practice adds another important dimension. By taking on roles at high schools or colleges through activities such as targeted site visits, job shadowing, or internships, community partners can experience the incremental instructional and assessment processes and better comprehend how their active participation in curriculum design and validation impacts the outcome. Business partners can also invite educators to spend time in industry to gain first-hand knowledge about the environments in which their students will work. Faculty members can share this knowledge with students. These experiences afford educators another important opportunity to validate curriculum. This type of business partner participation recognizes that, since business and industry are often the end users for education systems, their input is crucial.

Step 2: Design an assessment process that will deliver results.

The second step in the assessment phase is working with all partners to design assessment processes that not only deliver results to the education institutions, but also inform all partners about the effectiveness of the curriculum alignment.

Certification Check. A certification exam provides the ultimate assessment of what students know and can do. Industry or state licensing assessments are designed to validate and confirm that the person taking the test is knowledgeable and competent enough to function safely and effectively in the role or position. Since the results of such assessments are often the legal property of the student rather than the school or college, obtaining this data can be difficult (Achieve, Inc., 2008b). When available, data from certification exam results can be valuable to assess alignment of curriculum and advise revision; however, aggregated reports of institutional or departmental results can also be useful.

Some aggregate reports indicate only a pass/fail result, but others identify and rate specific knowledge or skill areas. For example, a state-tested Certified Nursing Assistant (CNA) exam report lists several different categories (e.g., basic nursing skills, safety/emergencies, infection control, resident's rights). A review of such an aggregate exam report may indicate chronic areas of weakness in specific categories. Such data, when available, can be a useful

tool in assessing the curriculum. If trends indicate recurrent weaknesses on a given component of the exam, faculty may consider reviewing and revising the content or instructional strategies in use.

If a certification exam does not exist, one strategy is to convene an advisory group to develop a proficiency checklist and use results of the checklist review to assess the effectiveness of curriculum alignment. Other assessment methods to consider may include the following:

- State high stakes tests;
- College placement tests;
- Retention and completion data;
- Capstone experiences like senior projects;
- Employability data;
- Employer satisfaction surveys; and
- Alumni follow-up surveys.

Step 3: Analyze the results of the assessment.

Drill Into the Data. Consider ways to more fully use the data already available at the school or college to inform your curriculum alignment work. For example, examine aggregate data on placement tests or diagnostic scores. Look for recurring trends in writing, reading, or math deficiencies. Disaggregate diagnostic data by high school and year of graduation to identify opportunities for improvement around specific skill areas.

The partnership may want to further examine data for equity gaps like race, gender, native language, socioeconomic status, special needs categories, and specific populations such as veterans.

Take advantage of the opportunity to learn from existing data and use that knowledge to inform continuous improvement decisions going forward.

THE PROCESS IN PRACTICE
Convene Partners to Review Alignment Outcomes

The Association for Career and Technical Education provided the highlights of the Carl D. Perkins CTE Improvement Act of 2006—Programs of Study (POS). Programs of study are based on Classification of Instructional Programs (CIP) codes. In October 2009, the CIP 15.1202 (computer technology) was one of many codes that were reviewed and revised by the Pennsylvania Department of Education (PDE). A panel of subject matter experts representing Career and Technical Institutes (CTI), community colleges, secondary schools, and four-year universities were involved.

Coming to a consensus was easy once each panel member learned what the others needed. The POS is a true dialogue that leads to statewide acceptance and possibly statewide articulation agreements.

According to the National Center for Education Statistics (nces.ed.gov), CIP codes were originally developed in 1980. They provide a taxonomic scheme that supports the accurate tracking and reporting of fields of study and program completion activity. These task charts have aided Lehigh Carbon Community College (LCCC) to create seamless articulation agreements with our CTIs. In addition to the POS, LCCC uses crosswalk templates that enable schools to indicate an identifying number of a competency as it correlates to the framework of the POS.

PDE has enhanced the POS with Students Occupationally and Academically Ready (SOAR) (www.education.state.pa.us). SOAR's mission is to prepare students for college and careers in a diverse, high-performing workforce. SOAR is a PDE approved, Career and Technical Education Program that credits skills and tasks learned at the secondary school level to postsecondary degree, diploma, or certificate program. (SOAR – FAQ).

One of the many advantages to this dialogue is that many of the CTI students are taking higher-level computer networking courses as dual-enrollment options. LCCC values the partnership with the CTI.

Submitted by Joyce Thompson
Lehigh Carbon Community College
Schnecksville, Pennsylvania

Step 4: Review and act on the analysis of assessment outcomes.

The fourth step in the assessment phase is reviewing the analysis of assessment outcomes, and then acting on the results of that review. Importantly, this step includes determining, where indicated, appropriate corrective action to revise curriculum to more closely match alignment expectations. Too often assessment results are not fed back into the process. Thus, the opportunity for continuous improvement is compromised or lost. Routine partnership meetings provide an opportune time and venue to review articulation or dual credit agreements and consider possible curriculum revisions. Frequent meetings also build and strengthen relationships and encourage discourse on emerging trends, policy changes, and institutional or organizational changes.

Further, these logical opportunities to convene partners are a good time to check in and exchange data and information. Do the assessment outcomes indicate that progress is being made to better align curriculum? Are there indicators that more students are being successful along their educational pathway? In addition to considering what is taught, when and where, also consider how the content is delivered. In some cases, all the necessary elements may be present within the curriculum, but there may be more effective ways in which to deliver the content to maximize learning and student engagement.

Summit or Roundtable Forum. Summits or roundtable discussions also provide good opportunities for partners to review curriculum and comprehensive programs of study. Such a forum allows discussions about resources, the effectiveness of curriculum and programming in meeting intended outcomes, and new or emerging industry trends. This format also serves to strengthen relationships, and may be a logical time to review articulation and dual credit agreements as well.

MAKING CONNECTIONS

Assessment

Contextualized instruction helps students understand how academic concepts have practical application in the workplace and in the world in which they live. Abstract academic concepts, sometimes delivered as isolated fragments of information in a traditional classroom lecture environment, can be difficult for students to understand. Students are more motivated and engaged when they understand why they are learning the concepts, the relevance of that knowledge, and how it will be used outside the classroom. Problem- or project-based instruction in a real-world context allows students to demonstrate what they know and can do. Through culminating problem-based projects, educators can assess student learning.

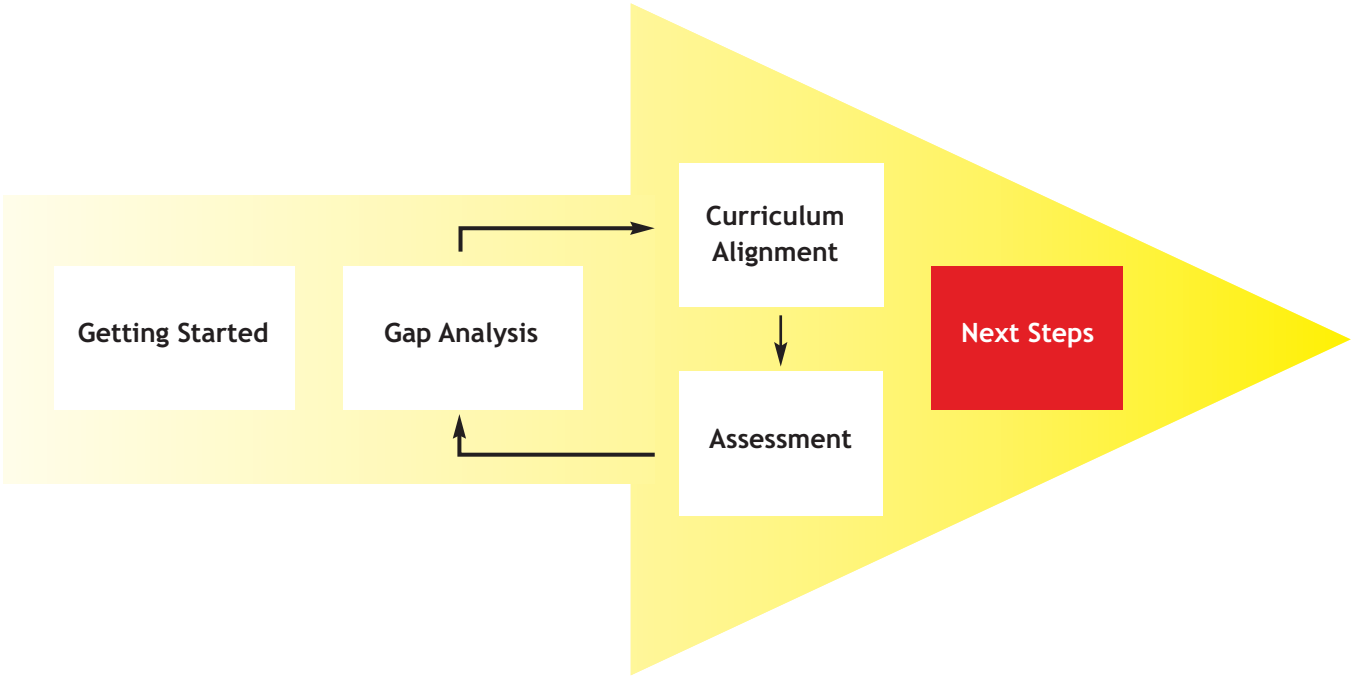
Project Lead The Way (PLTW) (www.pltw.org) is a successful, working example of contextualized instruction. PLTW classes deliver rigorous content in a hands-on environment where students work collaboratively to solve real-world problems. When students relate academic studies to a career context, they apply academic and technical knowledge in new situations enabling them to connect high school to their futures (Bottoms and Young, 2008).

Contextualized instruction like PLTW encourages faculty of all disciplines to learn to embed mathematics and literacy skills into curricula. Of equal importance, academic faculty can learn to teach their content within the context of practical and real-world applications. With collaboration and joint planning, high quality, integrated, and contextual learning experiences for students can be created by blending academic and technical studies (Bottoms and Young, 2008).

Assessment is a priority for PLTW. Senior capstone projects provide an opportunity for students to apply knowledge and skills learned throughout the multiyear curriculum. This provides a valuable assessment opportunity to inform educators about how the curriculum is performing. A new partnership between PLTW and Northwest Evaluation Association (NWEA) will help provide teachers with real-time assessment data and allow timely adjustments. Further, NWEA assessment tools will provide PLTW and educators with data on such items as

- student learning outcomes;
- ways PLTW students compare to non-PLTW students within the same school as well as with students across the country; and
- national graduation rates of PLTW students.

To learn more about Project Lead The Way (PLTW) visit www.pltw.org.



This Significant Discussions guide comes at a time when various forces are converging to produce positive and transformational change to improve student transitions and college and career readiness. We recognize that as a nation, we can no longer be satisfied with the low proportion of young adults with college credentials. There is a growing sense of urgency to increase the number of U.S. citizens who complete college degrees or credentials of value. President Obama has asked all Americans to commit to at least one year of higher education or career training. Members of Congress and others have committed tens of billions of dollars to support young Americans in completing college or some postsecondary training. Washington has challenged learners of the nation to return the U.S. to the top of the list of nations with the highest proportion of college graduates by 2020 (www.whitehouse.gov).

The 2009 MetLife Survey of the American Teacher: Collaborating for Student Success (www.metlife.com/teachersurvey) found that while most students believe it is important to continue their education beyond high school (68 percent) and fully plan to attend college (79 percent), only 55 percent feel confident that they will achieve their educational goals. Only 36 percent of teachers believe their students have the ability to succeed academically. Students and educators clearly recognize that very real barriers to student success exist. Systemic changes are needed to reduce such barriers, and Significant Discussions can be one tool to help better align curriculum across education systems and enable more students to successfully transition from high school to higher education and careers.

Next steps or recommendations can at times be categorized as lofty, noble aspirations that may seem unattainable or unaffordable. This guide suggests goals for systemic or policy changes that will improve student transitions. Further, the guide offers next steps that can be initiated or expanded immediately.

What the System Can Do

In a perfect world, considering what we know today about student transitions from high school to college, we would recommend reinventing our education systems with more focus on accountability across education levels. Faculty and administrators would view this as a critical part of their responsibility. Since it is unlikely that cross-institutional accountability reform of this magnitude will occur anytime soon, we are faced with either tolerating the situation as it

currently exists, or working to make incremental changes that will improve accountability and thus enhance the chances for student success as learners move from one system to another. To that end, we recommend that educational systems take the following steps.

Connect transition and completion. We know that a majority of students completing high school graduation requirements in this country are placed in remedial courses when they enter college, especially in the community college with its general open-admissions policy. We also know that the more remediation a student needs in college, the less likely that student is to complete any course or credential in college (Strong American Schools, 2008). It is unfortunate, then, that relatively few local and national projects focused on college completion do not have the transition issue as a high priority.

Recognize the value of cross-system partnerships. Important work in the area of career pathways over the past decade led to revisions in the Carl D. Perkins Career and Technical Education Improvement Act of 2006 (Perkins). Perkins requires collaboration across K-12, postsecondary, and business and industry partnerships to develop Programs of Study with a focus on planning for student success. Perkins provides a modest federal funding stream to states, which, in turn, provide funding to schools and colleges to support Career Technical Education (CTE). The approach may vary by state, with funding linked to various accountability measures and indicators of success, but collaborative partnerships are a foundational requirement. This is a resounding endorsement of the value and importance of partnerships engaging in Significant Discussions that lead to better curriculum alignment.

Provide incentives. Collaboration across systems of education is a requirement to qualify for Perkins funding. This incentive encourages such activities at a local level. Without exception, the community college representatives from the nine states participating in this Significant Discussions project reveal that collaboration between secondary and postsecondary faculty in cross-institutional curriculum alignment work has improved as a direct result of the financial incentive provided by Perkins funds.

This is fine for Career and Technical Education; it is a start. But what about the broader areas of education, the traditional general education or transfer education offered by community colleges? Who offers incentives for this type of cross-institutional, collaborative activity to expand this work across the entire academic and CTE continuum and ensure that math, language arts, social studies, and science curricula are aligned? What will be the source of an incentive to do this work? Who is going to fund this added, but critical, responsibility?

What the Institution Can Do

For this work to be done, for transitions to be eased and curricula to be adequately aligned, action is needed in educational institutions across the U.S. in the following areas.

Provide focused counseling. Recent Community College Survey of Student Engagement (CCSSE, 2008) data reveal that students progressing beyond compulsory K-12 schooling identify their highest need is assistance with a career plan and a clear understanding of what it will take for them to reach their educational goals and be successful in their chosen career field.

Ensure curriculum alignment. When the majority of community college students are enrolled in remedial education classes based on low placement test scores, drawing the conclusion that a curriculum alignment problem exists seems logical. This Significant Discussions guide offers a process through which secondary and postsecondary faculty can work together to eliminate that problem and help facilitate student success and completion.

Integrate curriculum. The traditional notion that academic and vocational education should be segregated is ripe for abandonment. Recent studies reveal that the same knowledge and skills are generally required to go to work as to go to college (Callan et al., 2006).Thus, integration of academic and career education curricula promises to enhance student success.

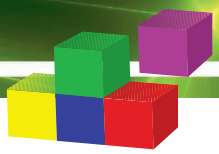
Contextualize learning. Bridgeland, Dilulio, and Burke Morison (2006) note that the leading reason students drop out of high school is boredom. They often ask, "Why do I need to learn this?" Development of curriculum around a career context provides students an answer to this persistent question by demonstrating to them the relevance of what they are learning. Employers benefit since contextualized curriculum ensures that skills and knowledge taught in the classroom are those needed in the workplace.

Progress in these major areas will occur in direct proportion to the fiscal and human resources that are devoted to bringing about positive changes. The urgency dictates that all stakeholders need to develop strategies to make progress even as systemic changes evolve.

What Individuals Can Do

All Stakeholders. The following steps are those all stakeholders can initiate or actively support.

- Educate colleagues and other stakeholders about the troubling trend of recent high school graduates needing remedial classes before enrolling in college-level courses. Inform colleagues of the staggering financial and human cost and its long-term consequences on the future workforce. Share with them strategies that have proven to be effective in improving the situation.
- Actively lead discussions and efforts, both internally and across educational levels, to align curriculum and intentionally integrate academic content in all curricula. Knowledge and skill statements and common core standards can provide the basis for these efforts. Academic and career and technical education faculty members, and ultimately students, stand to benefit from such discussions.
- Advocate for education reform that contextualizes academic and CTE curriculum and promotes alignment.
- Host, support, or participate in summits or roundtable discussions to encourage discourse and inform all stakeholders about issues and promising solutions related to successful student transitions.
- Foster and support a culture of learning that focuses on individual student success.
- Inform counselors, advisors, students, and parents about the mixed messages conveyed by high school exit exams, college admissions tests, placement tests, and enrollment in college-level courses.
- Host, support, or participate in parent orientation information sessions that focus on demystifying higher education. Include information on such topics as early assessment, financial aid, career pathways, college application, placement testing, and registration. Provide an opportunity for incoming students and their parents to interact with college faculty, staff, counselors, advisors, and administrators.
- Facilitate early placement testing opportunities and encourage high school students to take advantage of early placement testing so they have time to take high school courses or review sessions that will prepare them for entry into college-level courses. Encourage counselors to schedule students into appropriate high school courses or review sessions based on placement test scores.
- Promote delivery of remediation, study skills, and college and career transition courses in the high schools.
- Involve diverse stakeholders in school or college events such as open house and awards nights to build and enhance relationships.
- Understand constraints on educators and support them as your system allows (e.g., K-12 textbook regulations, access to restricted college course management systems). Whenever possible, remove or minimize barriers.
- Inform, and influence when possible, policy makers about the conditions that inhibit successful student transitions. Share with them strategies that have proven effective in enhancing student success.
- Advocate for high school exit competencies that exceed state standards to align more closely with college entrance competencies.



Administrators. Listed below are next steps administrators can initiate or actively support.

- Provide leadership in developing accountability across systems.
- Build collaborative work into promotion and tenure criteria.
- Engage counselors in helping to improve these conditions by allotting them more time with students and parents rather than imposing administrative tasks that are less directly related to college and career planning.
- Provide common planning time for faculty across systems to work together on curriculum alignment.
- Inform university schools of education about the need to prepare future educators to design curriculum, develop or select assessment strategies and instruments, and use instructional techniques that will help students be ready to move successfully across educational levels and into careers.
- Hire high school teachers as college adjunct instructors to help them become familiar with the demands and expectations of college curriculum.
- Facilitate regular joint professional development opportunities that bring secondary and postsecondary faculty together on a routine basis.
- Consider placing transition advisors on site at local high schools to serve as primary liaisons between the secondary school and college.

Faculty Members. Listed below are next steps faculty members can initiate or actively support.

- As curriculum content experts, faculty leaders can actively lead discussions that result in improved curriculum alignment.
- Consider how you teach as well as what you teach. Use instructional methods that resonate with today's learner. Integrate technology to expand access and enhance student engagement.
- Facilitate experiences for high school students and teachers on the high school campus, on the college campus, and in workplace environments.
- Initiate and facilitate concurrent or dual enrollment programs that provide high school students the opportunity to take college courses while still in high school.
- Invite K-12 teachers and college faculty to serve on each other's advisory committees.
- Facilitate experiences for students and teachers on high school and college campuses and in workplace environments.

Counselors and Advisors. Listed below are next steps counselors and advisors can initiate or expand upon.

- Make college and career advisement a major priority.
- Focus on authentic college and career readiness as a goal beyond graduation rates or high-stakes accountability measures.
- Encourage college students to enroll immediately in courses focused on their career interests, even while they complete remedial and general education courses. This connection to their interests will help keep them engaged (Bottoms and Young, 2008).
- Assist in facilitating on-site experiences for high school students on the college campus, college students in high school classes, and all students in workplace environments.

Business, Industry, and Community Partners. Listed below are next steps business, industry, and community partners can initiate or expand upon.

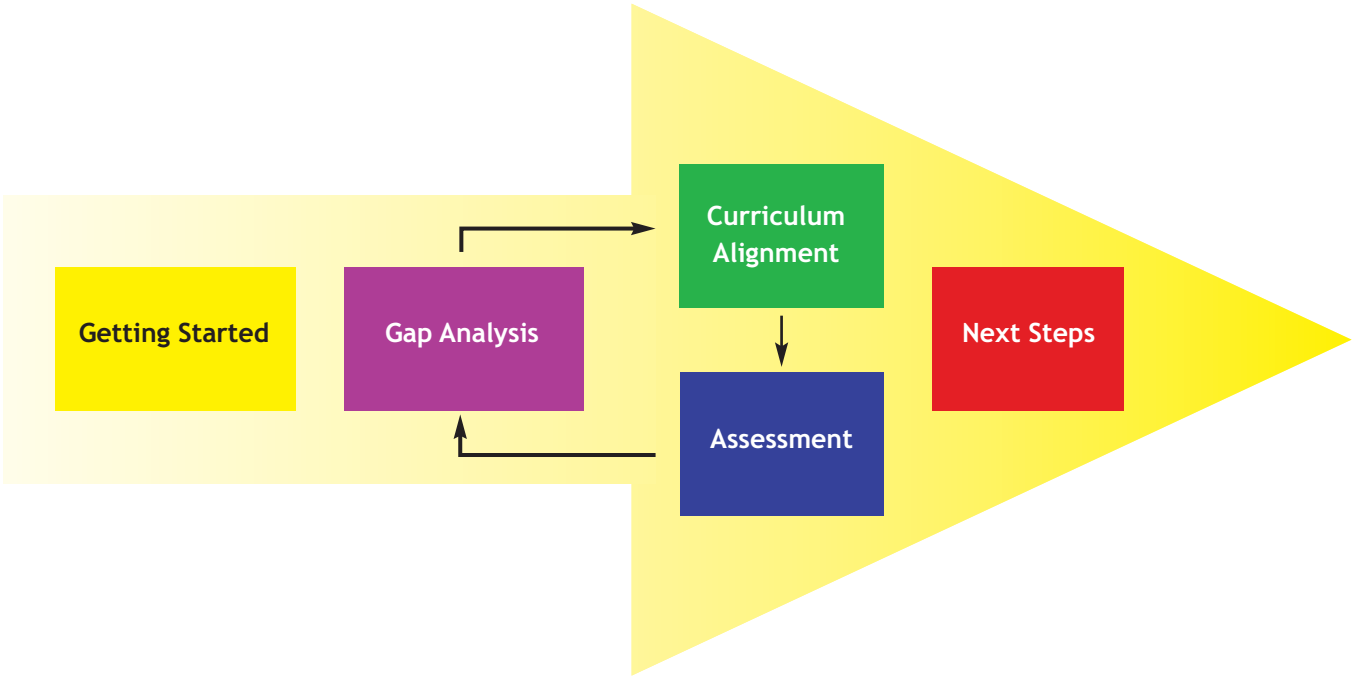
- Support educators in designing curriculum that integrates academic content and meets industry standards.
- Help educators develop problem-based assignments and assessments that provide real-world learning experiences for students.
- Provide externships to help educators understand industry and embed necessary knowledge into the curriculum.
- Whenever possible, share resources such as knowledge, expertise, and equipment, and provide guest speakers or host tours and field trips.

- Support student learning by providing real-world opportunities through job shadowing and internship experiences.
- Encourage and model active community involvement in local schools by participating in school decision-making processes, learning activities, and events that recognize and celebrate student achievement.

Closing Thoughts

We have discussed the high stakes and sizeable undertaking that falls within this framework we call Significant Discussions. In order to be successful, it will take the work of many—from the grass roots instructional level to the policy level. It will also require that American business and industry become more invested and participative in our educational systems. Significant Discussions provides a context within which to do this work. What has yet to be discussed in any detail is how this work is going to be accomplished. Accountability across systems cannot be assigned to volunteer work or ad hoc committees. Consider the very real cost of remediation and the lost revenue when students drop out of school. The math is easy: If the number of students needing remediation is decreased, less funding is spent on remedial sections and more funds are available for other purposes. In addition, calculate the lost revenue when a student drops out. A higher education official said recently, "We spend a great deal of money recruiting freshmen, but none to keep sophomores." The best opportunity to fund this long-term and important work is to use the dollars saved by providing less remedial education and the revenues generated from returning students who persist and complete rather than drop out. The most difficult step will be dedicating money to start and sustain this work until the savings and additional revenue are realized.

Perhaps the spigot of funding currently aimed at community college completion could be used to encourage work with other sectors of education and business and industry partners. Perhaps a portion of the funding could be used to make smooth secondary, postsecondary, and career transitions a universal reality, and to bring harmony to discordant systems that currently present barriers for student completion.



Getting Started Essentials

- ❑ Get the right people around the table.
- ❑ Understand the issues and challenges.
- ❑ Develop trusting relationships.
- ❑ Identify goals.

Gap Analysis Essentials

- ❑ Select a skilled facilitator.
- ❑ Identify the essential knowledge, skills and/or common core standards for review.
- ❑ Determine where and when the knowledge, skills, or core standards are delivered.
- ❑ Determine the degree or depth of learning.
- ❑ Identify the gaps.

Curriculum Alignment Essentials

- ❑ Identify the points in the curriculum to introduce or reinforce knowledge, skills, or core standards.
- ❑ Identify the resources necessary to integrate the knowledge, skills, or core standards into the sequence of instruction.
- ❑ Determine effective strategies to assess student acquisition of the knowledge, skills, or core standards.
- ❑ Review regularly for continuous improvement.

Assessment Essentials

- ❑ Determine the most effective strategies to validate curriculum alignment.
- ❑ Design an assessment process that will deliver results.
- ❑ Analyze the results of the assessment.
- ❑ Review and act on the analysis of assessment outcomes.

REFERENCES

Achieve, Inc. (2008a). *Out of Many, One: Toward Rigorous Common Core Standards From the Ground Up*. Washington, DC: Achieve, Inc. (Kramen, J. & Eresh, J.)

Achieve, Inc. (2008b). *The Perkins Act of 2006: Connecting Career and Technical Education With the College and Career Readiness Agenda*. Washington, DC: Achieve, Inc. (Meeder, H.)

ACT COMPASS sample exam. Retrieved from http://www.act.org/compass/sample/pdf/reading.pdf.

Alliance for Excellent Education. (2006). *Paying Double: Inadequate High Schools and Community College Remediation*. Washington, DC : Alliance for Excellent Education.

Bartholomew Consolidated School Corporation. Columbus, IN. Retrieved from www.bcsc.k12.in.us.

Bartnett, T., Ivy Tech Community College, personal communication, March 3, 2010.

Beauman, K., Anne Arundel Community College, Baltimore, MD, personal communication, February 15, 2010, March 27, 2010.

Blais, R., Southern Regional Educational Board, Atlanta, GA, personal communication, February 9, 2010.

Bloom, B. S. ed. (1956). *Taxonomy of Educational Objectives* (*Handbook One*). Appendix, pp 201-207. Cited in Vanderbilt University Center for Teaching and Learning. Retrieved from http://cft.vanderbilt.edu/teaching-guides/pedagogical/blooms-taxonomy.

Bottoms, G., & Young, M. (2008). *Lost in Transition: Building a Better Path From School to College and Careers*. Atlanta, GA: Southern Regional Education Board.

Bridgeland, J. M., Dilulio, J. J., and Burke Morison, K. (2006). *The Silent Epidemic: Perspectives of High School Dropouts*. A report by Civic Enterprises LLC in association with Peter D. Hart Research Associates.

Callan, P. M., Finney, J. E., Kirst, M. W., Usdan, M. D., & Venezia, A. (2006). *Claiming Common Ground*. San Jose, CA: The National Center for Public Policy and Higher Education.

College Board ACCUPLACER sample questions. Retrieved from http://professionals.collegeboard.com/profdownload/accuplacer-sample-questions-for-students.pdf.

Common Core State Standards Initiative. (2009). *College and Career Readiness Standards*. Retrieved from www.corestandards.org/Standards/index.htm.

Community College Survey of Student Engagement (CCSSE). (2008). *High Expectations and High Support*. Austin, TX: The University of Texas at Austin.

Conley, D. (2003). *Mixed Messages: What State High School Tests Communicate About Student Readiness for College*. Eugene, OR: Center for Educational Policy Research.

Dahlstrom, E., Project Director, ACCESS, Cal-PASS, personal communication, April 9, 2010.

Haycock, K. (2009 September 21). Quoted in Lederman, D. "Defining 'College Ready,'" Nationally. *Inside Higher Ed*. Retrieved from http://www.insidehighered.com/news/2009/09/21/core.

Haycock, K., Barth, P., Mitchell, R., and Wilkins, A., Eds. *Thinking K-16*. "Ticket to Nowhere: The Gap Between Leaving High School and Entering College and High-performance Jobs," pp. 2-33. Washington, DC: The Education Trust.

Hodapp, C., Curriculum Mapping Coordinator, Bartholomew Consolidated School Corporation, Columbus, IN, personal communication, February 3, 2010.

International Center for Leadership in Education. (2008). Rigor/Relevance Framework®. Information retrieved from http://www.leadered.com/rrr.html.

Jacobs, H. H., & Johnson, A. (2009). *Curriculum Mapping Planner: Templates, Tools, and Resources for Effective Professional Development*. Alexandria: VA: ASCD.

Kempner, K. (2008). *College and Career Transition Initiative Executive Summary: General Overview of Findings (unpublished)*. League for Innovation in the Community College. Phoenix, AZ.

McClenney, Kay, Director, Center for Community College Student Engagement (CCSSE), University of Texas at Austin, TX, personal communication, March 16, 2009.

MetLife Foundation. (2009). The MetLife Survey of The American Teacher. (2010). Retrieved from www.metlife.com/teachersurvey.

Metzler, M., Director, C4 Columbus Area Career Connection, Columbus, IN, personal communication, January 22, 2010.

Miami-Dade County Public Schools - //curriculum_materials.dadeschools.net/pacing_guides/

Miller, L., Corning, NY, personal communication, September 24, 2009.

National Center for Higher Education Management Systems. (www.nchems.org). Common Core Data; IPEDS Residency and Migration; Fall Enrollment; Graduation Rate Surveys. Retrieved from www.higheredinfo.org.

Obama, B., President of the United States. (2010). Compiled from speech transcripts retrieved at www.whitehouse.gov.

Ohio Department of Education. (2007 September). Ohio Competency Charts. Health Science. Career Field Technical Content Standards Document. Retrieved from http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEDetail.aspx?Page=3&TopicRelationID=1769&Content=89087.

Phillips, B., Executive Director, Cal-PASS, personal communication, March 18, 2010.

Project Lead The Way. Clifton Park, NY. Information retrieved from www.pltw.org.

Shipman, R., Curriculum Mapping Coordinator, Bartholomew Consolidated School Corporation Columbus, IN, personal communication, February 3, 2010.

States' Career Cluster Initiative. (2010). Information retrieved from www.careerclusters.org.

Strong American Schools. (2008). *Diploma to Nowhere*. Washington, DC: Strong American Schools.

The Woodrow Wilson National Fellowship Foundation. (2001). *Raising Our Sights: No High School Senior Left Behind*. National Commission on the High School Senior Year. Princeton, NJ.

Valdez, S., Director of Regional Collaboration, Cal-PASS, personal communication, March 31, 2010.

Venezia, A., Kirst, M., & Antonio, A. (2004). *Betraying the College Dream: How Disconnected K-12 and Postsecondary Systems Undermine Student Aspirations*. Final policy report from the Stanford University Bridge Project. Palo Alto, CA: The Stanford Institute for Higher Education Research.

Warford, L. J. (2006). *Pathways to Student Success: Case Studies From the College and Career Transitions Initiative*. Phoenix: League for Innovation in the Community College.

Weinheimer, R., English Department Chair, Columbus North High School, Columbus, IN, personal communication, September 23, 2009.

Whited, R., English Department Chair, Columbus East High School, Columbus, IN, personal communication, September 23, 2009.

DEFINITION OF TERMS

For the Significant Discussions project and discussion guide, the following definitions apply.

Accountability - a concept encompassing the obligation to report, explain, answer, and account for results or progress toward intended outcomes, expectations, and goals

Aggregate data - data combined from multiple sources

Assessment - the process of documenting, usually in measureable terms, knowledge, skills, attitudes, and preparation of the individual learner, a learning community (e.g., the class), the institution, or the educational system as a whole

Capstone exam or experience - a type of assessment that measures student learning outcomes at the conclusion of a course, series, or sequence of related courses

Career pathway - a coherent, articulated sequence of rigorous academic and career courses that embed the knowledge and skills necessary to prepare learners to pursue a wide range of career opportunities

CIP - Classification of Instructional Programs codes describe and categorize instructional programs

CTE - career and technical education

Competencies - a group of characteristics, native or acquired, that indicate an individual's knowledge, skills, and abilities in a given area

Contextual learning - instructional practices that position students to discover meaningful relationships between abstract ideas and practical application in a real-world context

Curriculum alignment - curriculum, including content, skills, and assessments, that is aligned to ensure students receive sequential instruction and exposure to information in order to achieve the identified learning objectives or outcomes

Curriculum gaps - unintended breaks in the learning continuum when relevant information is missed or not included in the curriculum

Curriculum maps - procedure to collect, review, and maintain documentation of the operational curriculum by using templates that illustrate when and how key content and skills are delivered and assessed

Disaggregated data - data sorted by specific subsets, such as gender, subject, grade level, or high school

End-of-course exam - similar to a final exam, often used as a statewide standardized test to measure what students know and are able to do upon completion of a course

Gap analysis - a comparison that identifies the difference between actual and desired outcomes, or whether requirements are met or not met

Integrated learning - blending abstract academic concepts with practical application strategies in a real-world context to help students make connections across disciplines

Pacing guides - a schedule that outlines when and how concepts, topics, and skills are addressed during the duration of a particular curriculum or class

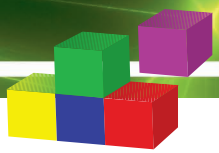
Persistence – an individual's continuous attendance and participation, or the collective rate at which students enroll and attend each subsequent term without interruption

Pipeline students - students who progress uninterrupted along an educational pathway (e.g., students who go directly from high school to postsecondary education)

Program of study (POS) - a coherent, articulated sequence of rigorous academic and career/technical courses, commencing in the ninth grade, that lead to a degree, an industry-recognized certificate, and/or licensure

PLTW - Project Lead The Way provides a hands-on curriculum that helps to develop problem-solving and critical thinking skills in STEM-related education

Remedial/developmental education – programs and courses designed for students to improve knowledge, skills, and abilities to correct a learning deficiency



STEM - science, technology, engineering, and math-related academic disciplines and careers

Spiraling curriculum - topics or concepts are repeatedly reviewed and reinforced, each time building on previous knowledge and becoming increasingly complex and sophisticated over time

Stakeholder - person, group, organization, or system that impacts or can be impacted by another organization's actions or activities

State standards - state-defined knowledge and skills students should possess at critical points in their educational career

Syllabus - a summary or description of the content, objectives, assignments, resources, and assessments used in a course or class

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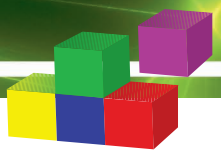

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Gap Analysis Tools

States' Career Cluster Initiative
Essential Knowledge and Skill Statements
14 pages

Following are the States' Career Cluster Initiative Essential Knowledge and Skill Statements. These are considered essential across all career clusters and careers. Various other knowledge and skill statements exist for all 16 career clusters. Your partnership may choose to begin the gap analysis by selecting knowledge and skill elements your partnership views to be most important.

For more detailed information, go to:
www.careerclusters.org/resources/pos_ks/Essential Statements - 100608.pdf.

The following knowledge and skill statements are essential to success for careers in all clusters and pathways. Persons preparing for careers at any level should be able to demonstrate these skills in the context of their chosen cluster and pathway.

Essential Topic ESS01	**ACADEMIC FOUNDATIONS:** ***Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.***
ESS01.01	**Complete required training, education, and certification to prepare for employment in a particular career field.**
ESS01.01.01	Identify training, education and certification requirements for occupational choice.
ESS01.01.02	Participate in career-related training and/or degree programs.
ESS01.01.03	Pass certification tests to qualify for licensure and/or certification in chosen occupational area.
ESS01.02	**Demonstrate language arts knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
ESS01.02.01	Model behaviors that demonstrate active listening.
ESS01.02.02	Adapt language for audience, purpose, situation. (i.e. diction/structure, style).
ESS01.02.03	Organize oral and written information.
ESS01.02.04	Compose focused copy for a variety of written documents such as: agendas, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, and technical terminology.
ESS01.02.05	Edit copy to create focused written documents such as: agendas, audio-visuals, bibliographies, drafts, forms/documents, notes, oral presentations, reports, and technical terminology.
ESS01.02.06	Comprehend key elements of oral and written information such as: cause/effect, comparisons/contrasts, conclusions, context, purpose, charts/tables/graphs, evaluation/critiques, mood, persuasive text, sequence, summaries, and technical subject matter.
ESS01.02.07	Evaluate oral and written information for: accuracy, adequacy/sufficiency, appropriateness, clarity, conclusions/solutions, fact/opinion, propaganda, relevancy, validity, and relationship of ideas.
ESS01.02.08	Identify assumptions, purpose, outcomes/solutions, and propaganda techniques.
ESS01.02.09	Predict potential outcomes and/or solutions based on oral and written information regarding trends.
ESS01.02.10	Present formal and informal speeches including: discussion, information requests, interpretation, and persuasive arguments.

ESS01.03	**Demonstrate mathematics knowledge and skills required to pursue the full range of post-secondary education and career opportunities.**
ESS01.03.01	Identify whole numbers, decimals, and fractions.
ESS01.03.02	Demonstrate knowledge of basic arithmetic operations such as: addition, subtraction, multiplication, and division.
ESS01.03.03	Demonstrate use of relational expressions such as: equal to, not equal, greater than, less than, etc.
ESS01.03.04	Apply data and measurements to solve a problem.
ESS01.03.05	Analyze Mathematical problem statements for missing and/or irrelevant data.
ESS01.03.06	Construct charts/tables/graphs from functions and data.
ESS01.03.07	Analyze data when interpreting operational documents.
ESS01.04	**Demonstrate science knowledge and skills required to pursue the full range of post-secondary and career education opportunities.**
ESS01.04.01	Evaluate scientific constructs including: conclusions, conflicting data, controls, data, inferences, limitations, questions, sources of errors, and variables.
ESS01.04.02	Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification.
Essential Topic ESS02	**COMMUNICATIONS:** ***Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.***
ESS02.01	**Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.**
ESS02.01.01	Determine the most appropriate reading strategy for identifying the overarching purpose of a text (i.e. skimming, reading for detail, reading for meaning or critical analysis).
ESS02.01.02	Demonstrate use of content, technical concepts and vocabulary when analyzing information and following directions.
ESS02.01.03	Select the reading strategy or strategies needed to fully comprehend the content within a written document (i.e., skimming, reading for detail, reading for meaning or critical analysis).
ESS02.01.04	Interpret information, data, and observations to apply information learned from reading to actual practice.
ESS02.01.05	Transcribe information, data, and observations to apply information learned from reading to actual practice.

ESS02.01.06	Communicate information, data, and observations to apply information learned from reading to actual practice.
ESS02.02	**Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication in the workplace.**
ESS02.02.01	Employ verbal skills when obtaining and conveying information.
ESS02.02.02	Record information needed to present a report on a given topic or problem.
ESS02.02.03	Write internal and external business correspondence that conveys and/or obtains information effectively.
ESS02.02.04	Communicate with other employees to clarify workplace objectives.
ESS02.02.05	Communicate effectively with customers and employees to foster positive relationships.
ESS02.03	**Locate, organize and reference written information from various sources to communicate with co-workers and clients/participants.**
ESS02.03.01	Locate written information used to communicate with co-workers and customers.
ESS02.03.02	Organize information to use in written and oral communications.
ESS02.03.03	Reference the sources of information.
ESS02.04	**Evaluate and use information resources to accomplish specific occupational tasks.**
ESS02.04.01	Use informational texts, Internet web sites, and/or technical materials to review and apply information sources for occupational tasks.
ESS02.04.02	Evaluate the reliability of information from informational texts, Internet Web sites, and/or technical materials and resources.
ESS02.05	**Use correct grammar, punctuation and terminology to write and edit documents.**
ESS02.05.01	Compose multi-paragraph documents clearly, succinctly, and accurately.
ESS02.05.02	Use descriptions of audience and purpose when preparing and editing written documents.
ESS02.05.03	Use correct grammar, spelling, punctuation, and capitalization when preparing written documents.
ESS02.06	**Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.**
ESS02.06.01	Prepare oral presentations to provide information for specific purposes and audiences.
ESS02.06.02	Identify support materials that will enhance an oral presentation.
ESS02.06.03	Prepare support materials that will enhance an oral presentation.
ESS02.06.04	Deliver an oral presentation that sustains listeners' attention and interest.

ESS02.06.05	Align presentation strategies to the intended audience.
ESS02.06.06	Implement multi-media strategies for presentations.
ESS02.07	**Interpret verbal and nonverbal cues/behaviors to enhance communication with co-workers and clients/participants.**
ESS02.07.01	Interpret verbal behaviors when communicating with clients and co-workers.
ESS02.07.02	Interpret nonverbal behaviors when communicating with clients and co-workers.
ESS02.08	**Apply active listening skills to obtain and clarify information.**
ESS02.08.01	Interpret a given verbal message/information.
ESS02.08.02	Respond with restatement and clarification techniques to clarify information.
ESS02.09	**Develop and interpret tables, charts, and figures to support written and oral communications.**
ESS02.09.01	Create tables, charts, and figures to support written and oral communications.
ESS02.09.02	Interpret tables, charts, and figures used to support written and oral communication.
ESS02.10	**Listen to and speak with diverse individuals to enhance communication skills.**
ESS02.10.01	Apply factors and strategies for communicating with a diverse workforce.
ESS02.10.02	Demonstrate ability to communicate and resolve conflicts within a diverse workforce.
ESS02.11	**Exhibit public relations skills to increase internal and external customer/client satisfaction.**
ESS02.11.01	Communicate effectively when developing positive customer/client relationships.

Essential Topic ESS03	**PROBLEM-SOLVING AND CRITICAL THINKING:** ***Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.***
ESS03.01	**Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate).**
ESS03.01.01	Identify common tasks that require employees to use problem-solving skills.
ESS03.01.02	Analyze elements of a problem to develop creative solutions.
ESS03.01.03	Describe the value of using problem-solving and critical thinking skills to improve a situation or process.
ESS03.01.04	Create ideas, proposals, and solutions to problems.
ESS03.01.05	Evaluate ideas, proposals, and solutions to problems.

ESS03.01.06	Use structured problem-solving methods when developing proposals and solutions.
ESS03.01.07	Generate new and creative ideas to solve problems by brainstorming possible solutions.
ESS03.01.08	Critically analyze information to determine value to the problem-solving task.
ESS03.01.09	Guide individuals through the process of recognizing concerns and making informed decisions.
ESS03.01.10	Identify alternatives using a variety of problem-solving and critical thinking skills.
ESS03.01.11	Evaluate alternatives using a variety of problem-solving and critical thinking skills.
ESS03.02	**Employ critical thinking and interpersonal skills to resolve conflicts with staff and/or customers.**
ESS03.02.01	Analyze situations and behaviors that affect conflict management.
ESS03.02.02	Determine best options/outcomes for conflict resolution using critical thinking skills.
ESS03.02.03	Identify with others' feelings, needs, and concerns.
ESS03.02.04	Implement stress management techniques.
ESS03.02.05	Resolve conflicts with/for customers using conflict resolution skills.
ESS03.02.06	Implement conflict resolution skills to address staff issues/problems.
ESS03.03	**Identify, write and monitor workplace performance goals to guide progress in assigned areas of responsibility and accountability.**
ESS03.03.01	Write realistic performance goals, objectives and action plans.
ESS03.03.02	Monitor performance goals and adjust as necessary.
ESS03.03.03	Recognize goal achievement using appropriate rewards in the workplace.
ESS03.03.04	Communicate goal achievement with managers and co-workers.
ESS03.04	**Conduct technical research to gather information necessary for decision-making.**
ESS03.04.01	Align the information gathered to the needs of the audience.
ESS03.04.02	Gather technical information and data using a variety of resources.
ESS03.04.03	Analyze information and data for value to the research objectives.
ESS03.04.04	Evaluate information and data to determine value to research objectives.

Essential Topic ESS04	**INFORMATION TECHNOLOGY APPLICATIONS:** ***Use information technology tools specific to the career cluster to access, manage, integrate, and create information.***
ESS04.01	**Use Personal Information Management (PIM) applications to increase workplace efficiency.**

ESS04.01.01	Manage personal schedules and contact information.
ESS04.01.02	Create memos and notes.
ESS04.02	**Employ technological tools to expedite workflow.**
ESS04.02.01	Use information technology tools to manage and perform work responsibilities.
ESS04.03	**Operate electronic mail applications to communicate within a workplace.**
ESS04.03.01	Use email to share files and documents.
ESS04.03.02	Identify the functions and purpose of email systems.
ESS04.03.03	Use email to communicate within and across organizations.
ESS04.04	**Operate Internet applications to perform workplace tasks.**
ESS04.04.01	Access and navigate Internet (e.g., use a web browser).
ESS04.04.02	Search for information and resources.
ESS04.04.03	Evaluate Internet resources for reliability and validity.
ESS04.05	**Operate writing and publishing applications to prepare business communications.**
ESS04.05.01	Prepare simple documents and other business communications.
ESS04.05.02	Prepare reports and other business communications by integrating graphics and other non-text elements.
ESS04.05.03	Prepare complex multi-media publications.
ESS04.06	**Operate presentation applications to prepare presentations.**
ESS04.06.01	Prepare presentations for training, sales and information sharing.
ESS04.06.02	Deliver presentations with supporting materials.
ESS04.07	**Employ spreadsheet applications to organize and manipulate data.**
ESS04.07.01	Create a spreadsheet.
ESS04.07.02	Perform calculations and analyses on data using a spreadsheet.
ESS04.08	**Employ database applications to manage data.**
ESS04.08.01	Manipulate data elements.
ESS04.08.02	Manage interrelated data elements.
ESS04.08.03	Analyze interrelated data elements.
ESS04.08.04	Generate reports showing interrelated data elements.
ESS04.09	**Employ collaborative/groupware applications to facilitate group work.**
ESS04.09.01	Facilitate group work through management of shared schedule and contact information.
ESS04.09.02	Facilitate group work through management of shared files and online information.
ESS04.09.03	Facilitate group work through instant messaging or virtual meetings.
ESS04.10	**Employ computer operations applications to manage work tasks.**
ESS04.10.01	Manage computer operations.

ESS04.10.02	Manage file storage.
ESS04.10.03	Compress or alter files.
ESS04.11	**Use computer-based equipment (containing embedded computers or processors) to control devices.**
ESS04.11.01	Operate computer driven equipment and machines.
ESS04.11.02	Use installation and operation manuals.
ESS04.11.03	Troubleshoot computer driven equipment and machines.
ESS04.11.04	Access support as needed to maintain operation of computer driven equipment and machines.
Essential Topic ESS05	**SYSTEMS:** ***Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.***
ESS05.01	**Describe the nature and types of business organizations to build an understanding of the scope of organizations.**
ESS05.01.01	List the types and functions of businesses.
ESS05.01.02	Describe the types and functions of businesses.
ESS05.01.03	Explain the functions and interactions of common departments within a business.
ESS05.02	**Implement quality control systems and practices to ensure quality products and services.**
ESS05.02.01	Describe quality control standards and practices common to the workplace.
Essential Topic ESS06	**SAFETY, HEALTH AND ENVIRONMENTAL:** ***Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.***
ESS06.01	**Implement personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.**
ESS06.01.01	Assess workplace conditions with regard to safety and health.
ESS06.01.02	Align safety issues with appropriate safety standards to ensure a safe workplace/jobsite.
ESS06.01.03	Identify safety hazards common to workplaces.
ESS06.01.04	Identify safety precautions to maintain a safe worksite.
ESS06.01.05	Select appropriate personal protective equipment as needed for a safe workplace/jobsite.
ESS06.01.06	Inspect personal protective equipment commonly used for selected career pathway.

ESS06.01.07	Use personal protective equipment according to manufacturer rules and regulations.
ESS06.01.08	Employ a safety hierarchy and communication system within the workplace/jobsite.
ESS06.01.09	Implement safety precautions to maintain a safe worksite.
ESS06.02	**Complete work tasks in accordance with employee rights and responsibilities and employers obligations to maintain workplace safety and health.**
ESS06.02.01	Identify rules and laws designed to promote safety and health in the workplace.
ESS06.02.02	State the rationale of rules and laws designed to promote safety and health.
ESS06.03	**Employ emergency procedures as necessary to provide aid in workplace accidents.**
ESS06.03.01	Use knowledge of First Aid procedures as necessary.
ESS06.03.02	Use knowledge of CPR procedures as necessary.
ESS06.03.03	Use safety equipment as necessary.
ESS06.04	**Employ knowledge of response techniques to create a disaster and/or emergency response plan.**
ESS06.04.01	Complete an assessment of an emergency and/or disaster situation.
ESS06.04.02	Create an emergency and/or disaster plan.

Essential Topic ESS07	**LEADERSHIP AND TEAMWORK:** ***Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.***
ESS07.01	**Employ leadership skills to accomplish organizational goals and objectives.**
ESS07.01.01	Analyze the various roles of leaders within organizations (e.g. contribute ideas; share in building an organization; act as role models to employees by adhering to company policies, procedures, and standards; promote the organization's vision; and mentor others).
ESS07.01.02	Exhibit traits such as empowerment, risk, communication, focusing on results, decision-making, problem solution, and investment in individuals when leading a group in solving a problem.
ESS07.01.03	Exhibit traits such as compassion, service, listening, coaching, developing others, team development, and understanding and appreciating others when acting as a manager of others in the workplace.
ESS07.01.04	Exhibit traits such as enthusiasm, creativity, conviction, mission, courage, concept, focus, principle-centered living, and change when interacting with others in general.

ESS07.01.05	Consider issues related to self, team, community, diversity, environment, and global awareness when leading others.
ESS07.01.06	Exhibit traits such as innovation, intuition, adaptation, life-long learning and coachability to develop leadership potential over time.
ESS07.01.07	Analyze leadership in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation.
ESS07.01.08	Describe observations of outstanding leaders using effective management styles.
ESS07.01.09	Participate in civic and community leadership and teamwork opportunities to enhance skills.
ESS07.02	**Employ organizational and staff development skills to foster positive working relationships and accomplish organizational goals.**
ESS07.02.01	Implement organizational skills when facilitating others' work efforts.
ESS07.02.02	Explain how to manage a staff that satisfies work demands while adhering to budget constraints.
ESS07.02.03	Describe how staff growth and development to increase productivity and employee satisfaction.
ESS07.02.04	Organize team involvement within a group environment.
ESS07.02.05	Work with others to develop and gain commitment to team goals.
ESS07.02.06	Distribute responsibility and work load fairly.
ESS07.02.07	Model leadership and teamwork qualities to aid in employee morale.
ESS07.02.08	Identify best practices for successful team functioning.
ESS07.02.09	Explain best practices for successful team functioning.
ESS07.03	**Employ teamwork skills to achieve collective goals and use team members' talents effectively.**
ESS07.03.01	Work with others to achieve objectives in a timely manner.
ESS07.03.02	Promote the full involvement and use of team members' individual talents and skills.
ESS07.03.03	Employ conflict management skills to facilitate solutions.
ESS07.03.04	Demonstrate teamwork skills though working cooperatively with co-workers, supervisory staff, and others, both in and out of the organization, to achieve particular tasks.
ESS07.03.05	Demonstrate teamwork processes that provide team building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution.
ESS07.03.06	Develop plans to improve team performance.
ESS07.03.07	Demonstrate commitment to and a positive attitude toward team goals.
ESS07.03.08	Take responsibility for shared group and individual work tasks.
ESS07.03.09	Assist team members in completing their work.
ESS07.03.10	Adapt effectively to changes in projects and work activities.
ESS07.03.11	Negotiate effectively to arrive at decisions.

ESS07.04	**Establish and maintain effective working relationships with all levels of personnel and other departments in order to accomplish objectives and tasks.**
ESS07.04.01	Build effective working relationships using interpersonal skills.
ESS07.04.02	Use positive interpersonal skills to work cooperatively with co-workers representing different cultures, genders and backgrounds.
ESS07.04.03	Manage personal skills to accomplish assignments.
ESS07.04.04	Treat people with respect.
ESS07.04.05	Provide constructive praise and criticism.
ESS07.04.06	Demonstrate sensitivity to and value for diversity.
ESS07.04.07	Manage stress and control emotions.
ESS07.05	**Conduct and participate in meetings to accomplish work tasks.**
ESS07.05.01	Develop meeting goals, objectives and agenda.
ESS07.05.02	Assign responsibilities for preparing materials and leading discussions.
ESS07.05.03	Prepare materials for leading discussion.
ESS07.05.04	Assemble and distribute meeting materials.
ESS07.05.05	Conduct meeting to achieve objectives within scheduled time.
ESS07.05.06	Demonstrate effective communication skills in meetings.
ESS07.05.07	Produce meeting minutes including decisions and next steps.
ESS07.05.08	Use parliamentary procedure, as needed, to conduct meetings.
ESS07.06	**Employ mentoring skills to inspire and teach others.**
ESS07.06.01	Use motivational techniques to enhance performance in others.
ESS07.06.02	Provide guidance to enhance performance in others.

Essential Topic ESS08	**ETHICS AND LEGAL RESPONSIBILITIES:** ***Know and understand the importance of professional ethics and legal responsibilities.***
ESS08.01	**Apply ethical reasoning to a variety of workplace situations in order to make ethical decisions.**
ESS08.01.01	Evaluate alternative responses to workplace situations based on legal responsibilities and employer policies.
ESS08.01.02	Evaluate alternative responses to workplace situations based on personal or professional ethical responsibilities.
ESS08.01.03	Identify personal and long-term workplace consequences of unethical or illegal behaviors.
ESS08.01.04	Explain personal and long-term workplace consequences of unethical or illegal behaviors.
ESS08.01.05	Determine the most appropriate response to workplace situations based on legal and ethical considerations.
ESS08.01.06	Explain the most appropriate response to workplace situations based on legal and ethical considerations.

ESS08.02	**Interpret and explain written organizational policies and procedures to help employees perform their jobs according to employer rules and expectations.**
ESS08.02.01	Locate information on organizational policies in handbooks and manuals.
ESS08.02.02	Discuss how specific organizational policies and procedures influence a specific work situation.
Essential Topic ESS09	**EMPLOYABILITY AND CAREER DEVELOPMENT:** ***Know and understand the importance of employability skills. Explore, plan, and effectively manage careers. Know and understand the importance of entrepreneurship skills.***
ESS09.01	**Identify and demonstrate positive work behaviors and personal qualities needed to be employable.**
ESS09.01.01	Demonstrate self-discipline, self-worth, positive attitude, and integrity in a work situation.
ESS09.01.02	Demonstrate flexibility and willingness to learn new knowledge and skills.
ESS09.01.03	Exhibit commitment to the organization.
ESS09.01.04	Identify how work varies with regard to site, from indoor confined spaces to outdoor areas, including aerial space and a variety of climatic and physical conditions.
ESS09.01.05	Apply communication strategies when adapting to a culturally diverse environment.
ESS09.01.06	Manage resources in relation to the position (i.e. budget, supplies, computer, etc).
ESS09.01.07	Identify positive work-qualities typically desired in each of the career cluster's pathways.
ESS09.01.08	Manage work roles and responsibilities to balance them with other life roles and responsibilities.
ESS09.02	**Develop a personal career plan to meet career goals and objectives.**
ESS09.02.01	Develop career goals and objectives as part of a plan for future career direction.
ESS09.02.02	Develop strategies to reach career objectives.
ESS09.03	**Demonstrate skills related to seeking and applying for employment to find and obtain a desired job.**
ESS09.03.01	Use multiple resources to locate job opportunities.
ESS09.03.02	Prepare a résumé.
ESS09.03.03	Prepare a letter of application.
ESS09.03.04	Complete an employment application.
ESS09.03.05	Interview for employment.

ESS09.03.06	List the standards and qualifications that must be met in order to enter a given industry.
ESS09.03.07	Employ critical thinking and decision-making skills to exhibit qualifications to a potential employer.
ESS09.04	**Maintain a career portfolio to document knowledge, skills and experience in a career field.**
ESS09.04.01	Select educational and work history highlights to include in a career portfolio.
ESS09.04.02	Produce a record of work experiences, licenses, certifications and products.
ESS09.04.03	Organize electronic or physical portfolio for use in demonstrating knowledge, skills and experiences.
ESS09.05	**Demonstrate skills in evaluating and comparing employment opportunities in order to accept employment positions that match career goals.**
ESS09.05.01	Compare employment opportunities to individual needs and career plan objectives.
ESS09.05.02	Evaluate employment opportunities based upon individual needs and career plan objectives.
ESS09.05.03	Demonstrate appropriate methods for accepting or rejecting employment offers.
ESS09.06	**Identify and exhibit traits for retaining employment to maintain employment once secured.**
ESS09.06.01	Model behaviors that demonstrate reliability and dependability.
ESS09.06.02	Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite.
ESS09.06.03	Complete required employment forms and documentation such as I-9 form, work visa, W-4 and licensures to meet employment requirements.
ESS09.06.04	Summarize key activities necessary to retain a job in the industry.
ESS09.06.05	Identify positive work behaviors and personal qualities necessary to retain employment.
ESS09.07	**Identify and explore career opportunities in one or more career pathways to build an understanding of the opportunities available in the cluster.**
ESS09.07.01	Locate and identify career opportunities that appeal to personal career goals.
ESS09.07.02	Match personal interest and aptitudes to selected careers.
ESS09.08	**Recognize and act upon requirements for career advancement to plan for continuing education and training.**
ESS09.08.01	Identify opportunities for career advancement.

ESS09.08.02	Pursue education and training opportunities to acquire skills necessary for career advancement.
ESS09.08.03	Examine the organization and structure of various segments of the industry to prepare for career advancement.
ESS09.08.04	Research local and regional labor (workforce) market and job growth information to project potential for advancement.
ESS09.08.05	Manage employment relations to make career advancements.
ESS09.09	**Continue professional development to keep current on relevant trends and information within the industry.**
ESS09.09.01	Use self assessment, organizational priorities, journals, Internet sites, professional associations, peers and other resources to develop goals that address training, education and self-improvement issues.
ESS09.09.02	Read trade magazines and journals, manufacturers' catalogues, industry publications and Internet sites to keep current on industry trends.
ESS09.09.03	Participate in relevant conferences, workshops, mentoring activities and in-service training to stay current with recent changes in the field.
ESS09.10	**Examine licensing, certification and credentialing requirements at the national, state and local levels to maintain compliance with industry requirements.**
ESS09.10.01	Examine continuing education requirements related to licensing, certification, and credentialing requirements at the local, state and national levels for chosen occupation.
ESS09.10.02	Examine the procedures and paperwork involved in maintaining and updating licensure, certification and credentials for chosen occupation.
ESS09.10.03	Align ongoing licensing, certification and credentialing requirements to career plans and goals.
ESS09.11	**Examine employment opportunities in entrepreneurship to consider entrepreneurship as an option for career planning.**
ESS09.11.01	Describe the opportunities for entrepreneurship in a given industry.
Essential Topic ESS10	**TECHNICAL SKILLS:** ***Use of technical knowledge and skills required to pursue careers in all career cluster, including knowledge of design, operation, and maintenance of technological systems critical to the career cluster.***
ESS10.01	**Employ information management techniques and strategies in the workplace to assist in decision-making.**
ESS10.01.01	Use information literacy skills when accessing, evaluating and disseminating information.
ESS10.01.02	Describe the nature and scope of information management.
ESS10.01.03	Maintain records to facilitate ongoing business operations.

ESS10.02 Employ planning and time management skills and tools to enhance results and complete work tasks.

ESS10.02.01	Develop goals and objectives.
ESS10.02.02	Prioritize tasks to be completed.
ESS10.02.03	Develop timelines using time management knowledge and skills.
ESS10.02.04	Use project-management skills to improve workflow and minimize costs.

Gap Analysis Tools

States' Career Cluster Initiative
Education and Training Career Cluster Knowledge and Skill Statements
(five page sample)

Your partnership may choose to begin a gap analysis process by identifying the most critical elements from the Knowledge and Skill Statements for any given career pathway. Following is a sample of Knowledge and Skill Statements for the Education and Training Career Cluster. Some of these performance elements were used in the Anne Arundel Community College Education and Training Gap Analysis for CCTI (Appendix A-3).

For more detailed information, go to:
www.careerclusters.org/resources/pos_ks/FoundationKSCharts/2008/ET-159-KSCHART.pdf.

Education and Training Career Cluster
Cluster (Foundation) Knowledge and Skill Statements

The following Cluster (Foundation) Knowledge and Skill Chart provides statements that apply to all careers in the Education and Training Cluster. Persons preparing for careers in the Education and Training Cluster should be able to demonstrate these skills in addition to those found on the Essential Knowledge and Skills Chart. The Pathway Knowledge and Skill Charts are available in separate documents.

Cluster Topic EDC01	**ACADEMIC FOUNDATIONS:** ***Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.***
EDC01.01	**Employ fundamental principles of psychology to enhance learner achievement.**
EDC01.01.01	Employ fundamental knowledge of developmental theory to enhance learner achievement.
sample indicators	Identify major theorists. Explain major theories using real-world examples. Critique major theories. Use theory to predict and explain individual and group behavior.
EDC01.01.02	Employ fundamental knowledge of learning theory to enhance learner achievement.
sample indicators	Identify major theorists. Explain major theories using real-world examples. Critique major theories. Use theory to predict and explain individual and group behavior.
EDC01.01.03	Employ fundamental knowledge of motivation theory to enhance learner achievement.
sample indicators	Identify major theorists. Explain major theories using real-world examples. Critique major theories. Use theory to predict and explain individual and group behavior.
EDC01.01.04	Employ fundamental knowledge of the dynamics of psychological change to enhance professional practice.
sample indicators	Identify major theorists. Explain major theories using real-world examples. Critique major theories. Use theory to predict and explain individual and group behavior.
EDC01.02	**Employ fundamental principles of sociology to enhance learner achievement.**
EDC01.02.01	Employ fundamental knowledge of the social interaction of individuals and institutions to enhance learner achievement.
sample indicators	Identify multiple social factors and institutions that impact learning. Explain factors using real-world examples. Use social interaction of individuals and institutions to predict and explain individual and group behavior.
EDC01.02.02	Analyze social barriers to learning.
sample indicators	Identify multiple barriers. Explain barriers using real-world examples. Propose solutions to barriers.

EDC01.02.03 Employ fundamental knowledge of the dynamics of sociological change to enhance professional practice.

sample indicators
- Identify major theorists.
- Explain major theories using real-world examples.
- Critique major theories.
- Use theory to predict and explain individual and group behavior.

EDC01.03 Utilize knowledge about the history and belief systems of multiple cultural, ethnic, and racial groups to enhance learner achievement.

EDC01.03.01 Explain the history of multiple cultural, ethnic, and racial groups as it relates to learning.

sample indicators
- Explain history that relates to learning settings and institutions.
- Explain history that relates to family and community.
- Explain history that relates to work.

EDC01.03.02 Explain multiple cultural, ethnic, and racial groups' belief systems that relate to learning.

sample indicators
- Explain achievement belief systems.
- Explain life goals belief systems.

EDC01.04 Analyze and apply knowledge of the relationships between education and society to enhance learner achievement.

EDC01.04.01 Employ fundamental knowledge of educational philosophies to enhance learner achievement.

sample indicators
- Identify major philosophers.
- Explain major philosophies using real-world examples.
- Critique major philosophies.
- Relate educational philosophies to contemporary issues in professional practice.

EDC01.04.02 Analyze structures for governing professional practices in learning settings.

sample indicators
- Identify multiple governance structures.
- Explain governance structures using real-world examples.
- Critique governance structures.
- Relate governance structures to contemporary issues in professional practice.

EDC01.04.03 Apply fundamental knowledge of economics to enhance learner achievement.

sample indicators
- Identify major economic factors affecting learning and educational practice.
- Explain factors using real world examples.
- Relate factors to local funding issues.

EDC01.05 Explain and apply a variety of instructional models to enhance learning achievement.

EDC01.05.01 Explain models of instruction.

sample indicators
- Explain various models.
- Explain optimal contexts for using models.

EDC01.05.02 Employ models of instruction to enhance learner achievement.

sample indicators
- Use various models.
- Explain appropriateness of models in terms of context and learner results.

EDC01.06 Employ knowledge of assessment methods to enhance learner achievement.

EDC01.06.01 Employ fundamental knowledge of measurement to enhance learner achievement.

sample indicators
- Explain concepts of measurement.
- Measure educational outcomes appropriately.
- Interpret measurements appropriately.

EDC01.06.02 Employ fundamental knowledge of non-numeric data to enhance learner achievement.

sample indicators
- Explain concepts of non-numeric data.
- Collect non-numeric data appropriately.
- Interpret non-numeric data appropriately.

EDC01.07 Employ knowledge of economic principles to enhance understanding of professional practices in learning settings.

EDC01.07.01 Employ fundamental knowledge of macroeconomics to enhance funding for professional practices in learning settings.

sample indicators
- Identify major macroeconomic factors.
- Explain factors using real-world examples.
- Relate factors to contemporary funding issues.

EDC01.07.02 Employ fundamental knowledge of microeconomics to enhance funding for professional practices in learning settings.

sample indicators
- Identify major microeconomic factors.
- Explain factors using real-world examples.
- Relate factors to local funding issues.

Cluster Topic EDC02 COMMUNICATIONS: *Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.*

EDC02.01 Apply verbal communication skills to enhance learning and stakeholder commitment to learning organization.

EDC02.01.01 Provide information using motivational and engaging communication techniques.

sample indicators
- Cite data.
- Explain relevance to audience and context.
- Explain the significance of the tone of the communication.
- Use concise, coherent organization.
- Use language, terminology, and complexity suitable to audience.
- Use language sensitive to culture and gender.
- Address multiple intelligences and modalities.
- Use appropriate volume, rate, and clarity of voice.
- Use multiple mediums.

EDC02.01.02 Enlist stakeholder commitment using persuasive communication techniques.

sample indicators
- Create awareness of problem.
- Explain relevance to audience and context.
- Propose needed action and the role of the audience in that action.
- Create visualization of effects of proposed action.
- Explain the significance of the tone of the communication.
- Use concise, coherent organization.
- Use language, terminology, and complexity suitable to audience.
- Use language sensitive to culture and gender.

Address multiple intelligences and modalities.
Use appropriate volume, rate, and clarity of voice.
Use multiple mediums.

EDC02.01.03 Use non-verbal communication to enhance verbal communication.
sample indicators
Explain the congruency between non-verbal and verbal communication.
Describe intentional use of appearance, gesture, and tone of voice.

EDC02.01.04 Customize communication messages to fit the audience members.
sample indicators
Describe audience characteristics.
Explain alignment of communication components to audience characteristics.

EDC02.01.05 Recognize and address barriers to oral communication.
sample indicators
Address language barriers.
Explain alignment of communication components to audience characteristics.

EDC02.01.06 Give clear verbal directions.
sample indicators
Organize steps logically.
Use language, terminology, and complexity suitable to audience.
Reference prior knowledge and experience of audience.
Address both content and processes.
Use appropriate volume, rate, and clarity of voice.

EDC02.01.07 Utilize feedback to improve communication.
sample indicators
Interpret verbal and non-verbal feedback.
Allow appropriate response time based on audience and context.
Adapt communication based on feedback.

EDC02.02 Employ communication skills in interactive situations to enhance learning and stakeholder commitment to the organization.

EDC02.02.01 Utilize interviewing skills.
sample indicators
Obtain complete information.
Maintain focus on interview objectives.
Explain evidence that interviewee understood the purpose of the interview and the information conveyed in the interview.

EDC02.02.02 Utilize discussion skills.
sample indicators
Construct objectives for the discussion.
Describe evidence that participants actively contributed.
Maintain focus on discussion topic.
Explain evidence that participants' understanding of the topic advanced.

EDC02.02.03 Utilize questioning skills.
sample indicators
Describe evidence that participants actively responded.
Questions are suitable for audience and context in terms of Bloom's Taxonomy of higher-order thinking.
Explain evidence that participants' understanding of the topic advanced.

EDC02.02.04 Apply listening skills to enhance learning and stakeholder investment in learning organization.
sample indicators
Explain components of active listening.
Describe barriers to effective listening.

EDC02.02.05 Follow verbal directions.
sample indicators
Follow directions completely.
Follow directions precisely.

EDC02.03 Use writing skills to enhance stakeholder commitment to the learning organization.

EDC02.03.01 Write informational correspondence to stakeholders in the learning environment.

sample indicators
- Use language, terminology, and complexity suitable to audience.
- Use concise, coherent organization.
- Explain the significance of the tone of the correspondence.
- Use language sensitive to culture and gender.

EDC02.03.02 Write clear directions for learners.

sample indicators
- Organize steps logically.
- Use language, terminology, and complexity suitable to audience.
- Address both content and processes.
- Use concise, coherent organization.

EDC02.03.03 Write summative reports regarding the learning environment.

sample indicators
- Cite data.
- Use language, terminology, and complexity suitable to audience.
- Address both positive and negative aspects of the topic.
- Use language sensitive to culture and gender.

EDC02.03.04 Write position papers on issues affecting learning environments and organizations.

sample indicators
- Cite data.
- Synthesize multiple sources of information.
- Use persuasive communication.
- Use coherent organization.
- Use language and terminology suitable to audience.
- Use language sensitive to culture and gender.

EDC02.03.05 Write requests for funding, resources, and services in the learning setting.

sample indicators
- Describe required formatting and components.
- Include all required components.
- Use language and terminology suitable to audience.
- Cite data.
- Use persuasive communication.
- Use concise, coherent organization.
- Use language sensitive to culture and gender.

EDC02.03.06 Employ graphic communication to enhance learning and stakeholder investment in learning organization.

sample indicators
- Explain relevance to audience and context.
- Use complexity suitable to audience.
- Graphics can be easily seen and read.

EDC02.04 Use knowledge of reading strategies in the content area to enhance learner achievement.

EDC02.04.01 Model reading strategies (skimming, reading for detail, reading for meaning and critical analysis) for determining the purpose of text.

sample indicators
- Use reading strategy to achieve intended purpose.
- Identify complexity of text(s).
- Evaluate and explain relevance, accuracy and appropriateness to purpose.

EDC02.04.02 Understand content, technical concepts, and vocabulary to analyze information and follow directions.

sample indicators
- Identify issues and questions.
- Analyze information presented in a variety of formats, such as tables, lists, figures, etc.

Gap Analysis Tools

Anne Arundel Community College
CCTI Site Partnership Gap Analysis
Education and Training
(complete four-page gap analysis)

Following is the Anne Arundel Community College Education and Training Gap Analysis for CCTI. AACC evaluated whether Knowledge and Skill Performance Elements were present in the high school, community college, or four-year university curriculum.

AACC Gap Analysis completed by Colleen Eisenbeiser, Director, Teacher Education and Childcare Institute.

AACC Gap Analysis provided by Kathleen Beauman, Director, Business Education Partnerships.

Cluster Knowledge and Skill Statements

Symbol Legend:
☑ Included in curriculum
✓ Minor coverage in curriculum
☐ Absent from the curriculum

Note:
Teacher Education is a 4-year degree program with numerous state mandates tied to the curriculum content and sequence. Many aspects of the curriculum are repeatedly reinforced and/or presented in more depth as the program continues; while other aspects of the curriculum are reserved for the last two years.

Academic Foundations	*Anne Arundel County High Schools Intro to Teaching Professions*	*Anne Arundel Community College*	*4 year college/university*	
Apply fundamental knowledge of psychology to enhance learner achievement.	☑	☑	☑	
Apply fundamental knowledge of sociology to enhance learner achievement.	☑	☑	☑	
Apply fundamental knowledge of cultural, ethnic, and racial groups to enhance learner achievement.	☑	☑	☑	
Apply fundamental knowledge of the relationships between education and society to enhance learner achievement.	☑	☑	☑	
Apply fundamental knowledge of instructional strategies to enhance learner achievement.	☑	☑	☑	
Apply fundamental knowledge and skills of assessment to enhance learner achievement.	☑	☑	☑	
Apply fundamental knowledge of economics to enhance learner achievement.	☐	✓	☑	

Communications				
Apply verbal communication skills to enhance learning and stakeholder commitment to learning organization.	✓	☑	☑	
Employ interactive communication to enhance learning and stakeholder commitment to learning organization.	✓	☑	☑	
Apply writing skills to enhance learning and stakeholder investment in learning organization.	✓	☑	☑	
Problem Solving and Critical Thinking				
Apply problem solving and critical thinking skills to enhance instruction and learner achievement.	☑	☑	☑	
Apply critical thinking to respond to educational issues.	☑	☑	☑	
Information Technology Applications				
Use Personal information Management (PIM)/ Productivity applications.	✓	☑	☑	
Use Electronic Mail applications.	✓	☑	☑	
Use Internet applications.	✓	☑	☑	
Use Writing/Publishing applications.	☑	☑	☑	
Use presentation applications.	☑	☑	☑	
Use Collaborative/Groupware applications.	☐	✓	☑	
Use Computer Operations applications.	☐	☑	☑	

Systems				
Use systems theory to explain models of education delivery.	☐	☑	☑	
Form, sustain, and modify instructional systems to facilitate learning.	☐	☑	☑	
Safety, Health, and Environmental				
Control risks to safety, health, and environment in the learning setting.	☐	✓	☑	
Use emergency procedures as necessary.	☐	✓	☑	
Leadership and Teamwork				
Apply planning knowledge and skills to enhance professional practice.	☐	✓	☑	
Apply group processing knowledge and skills to enhance professional practice.	☐	✓	☑	
Ethics and Legal Responsibilities				
Explain ethical and legal boundaries of professional practice in learning settings.	✓	☑	☑	
Explain legal rights that apply within learning settings.	✓	☑	☑	
Exhibit ethical and legal behavior in practice.	☐	☐	☑	
Employability and Career Development				
Use research skills to explore career options.	☑	☑	☑	
Acquire state-specific certification	☐	☑	☑	

/license/credentialing required to practice.				
Complete state-specific requirements to maintain employment and advance career.	☐	☐	☑	
Technical Skills				
Employ planning skills to enhance professional practice.	✓	☑	☑	
Employ organizational skills to enhance professional practice.	☐	☐	☑	
Employ presentation skills to enhance professional practice.	✓	✓	☑	
Employ group management skills to enhance professional practice.	✓	☑	☑	
Employ assessment skills to enhance professional practice.	☐	☑	☑	

Gap Analysis Tools

States' Career Cluster Initiative
Information Technology Career Cluster Knowledge and Skill Statements
(four-page sample)

Your partnership may choose to begin a gap analysis process by identifying the most critical elements from the Knowledge and Skill Statements for any given career pathway. Following is a sample of Knowledge and Skill Statements for the Information Technology Career Cluster. Some of these performance elements were used in the Corning Community College Information Technology Gap Analysis for CCTI (Appendix A-5).

For more detailed information, go to:
www.careerclusters.org/resources/pos_ks/FoundationKSCharts/2008/IT-102-KSCHART.pdf.

Information Technology Career Cluster
Cluster Knowledge and Skill Statements

The following Cluster (Foundation) Knowledge and Skill Chart provides statements that apply to all careers in the Information Technology Cluster. Persons preparing for careers in the Information Technology Cluster should be able to demonstrate these skills in addition to those found on the Essential Knowledge and Skills Chart. The Pathway Knowledge and Skill Charts are available in separate documents.

Cluster Topic ITC01	**ACADEMIC FOUNDATIONS:** ***Achieve additional academic knowledge and skills required to pursue the full range of career and postsecondary education opportunities within a career cluster.***
	No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.
Cluster Topic ITC02	**COMMUNICATIONS:** ***Use oral and written communication skills in creating, expressing and interpreting information and ideas including technical terminology and information.***
ITC02.01	**Develop positive customer relations to build and maintain a customer base in the IT industry.**
ITC02.01.01	Demonstrate knowledge of organization's offerings and of customers' importance to the organization.
Sample Indicators	Identify organization's products and services (including own strengths as an agent of the company). Recognize the importance of all customers to the business.
ITC02.01.02	Demonstrate ability to assist customers in a professional manner.
Sample Indicators	Determine customers' individual needs. Project a professional business image (e.g., appearance, voice, grammar, word usage, enunciation, nonverbal communication). Interact with customers and colleagues in a professional manner (e.g., prompt, friendly, courteous, respectful, helpful, knowledgeable, understandable). Ensure that your assistance promotes the best interests of the company.
ITC02.01.03	Effectively use organizational protocols and systems to fulfill customer service requirements.
Sample Indicators	Comply with established business protocols and company policies. Communicate company policies to customers. Handle merchandise returns in accordance with customer service policy. Handle customer complaints in accordance with customer service policy. Facilitate customer service through the maintenance of key information systems.
ITC02.01.04	Ensure that customers' needs are met to maintain a customer base.
Sample Indicators	Follow through on commitments made to customers(e.g., special orders, delivery specifications, new items). Maintain customer base.
ITC02.02	**Perform scheduling functions to meet customer needs.**
ITC02.02.01	Schedule customer appointments.
Sample Indicators	Create calendars/schedules. Maintain appointment calendars. Process requests for appointments. Verify appointments.

Notify customers of changes in schedule.
Manage scheduling conflicts.

ITC02.02.02 Document results of customer appointments.

Sample Indicators
Document results.

Cluster Topic ITC03	**PROBLEM-SOLVING AND CRITICAL THINKING:** ***Solve problems using critical thinking skills (analyze, synthesize, and evaluate) independently and in teams. Solve problems using creativity and innovation.***

ITC03.01 Use product/service design processes and guidelines to produce a quality IT product/service.

ITC03.01.01 Summarize the process of IT product/service design.

Sample Indicators
Test products for reliability.
Initiate predictive maintenance procedures.
Document a Quality Assurance (QA) program (includes creating a plan and evaluating effectiveness of the program).

ITC03.01.02 Plan for products/services using reliability factors.

ITC03.01.03 Create products/services using reliability factors.

ITC03.01.04 Test new products/services for reliability.

ITC03.01.05 Maintain the reliability of new products/services.

ITC03.02 Implement problem-solving processes to evaluate and verify the nature of problems in the IT industry.

ITC03.02.01 Explain information systems theory and practice.

Sample Indicators
Demonstrate knowledge of the underlying concepts of the information systems discipline.
Demonstrate knowledge of methods for achieving productivity in knowledge work.
Apply general systems theory to the analysis and development of an information system.
Identify procedures for formal problem-solving.
Demonstrate knowledge of the fundamental concept of information theory and organizational system processes.
Identify the essential properties of information systems.

ITC03.02.02 Explain information systems problem-solving techniques and approaches.

ITC03.02.03 Evaluate information systems problem-solving techniques and approaches.

ITC03.03 Employ organization and design principles to sort and group information used in the IT industry.

ITC03.03.01 Demonstrate the use of information organization principles.

Sample Indicators
Demonstrate knowledge of group support technology for common knowledge requirements.
Demonstrate knowledge of the information analysis process.
Demonstrate knowledge of Information Technology solutions.
Demonstrate knowledge of methods for achieving productivity in knowledge work.

ITC03.03.02 Demonstrate the use of design and color principles.

Cluster Topic ITC04	**INFORMATION TECHNOLOGY APPLICATIONS:** ***Use information technology tools specific to the career cluster to access, manage, integrate, and create information.***
	No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

Cluster Topic ITC05	**SYSTEMS:** ***Understand roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. Identify how key organizational systems affect organizational performance and the quality of products and services. Understand global context of industries and careers.***

ITC05.01 **Analyze and summarize the use of IT in business to enhance effectiveness.**

ITC05.01.01 Integrate IT into various types of business models.

Sample Indicators

- Determine how business activities interface with data processing functions.
- Differentiate between the role of information systems within a company and their role in a global environment.
- Measure increases in productivity realized by the implementation of information systems.

ITC05.02 **Implement cross-functional teams to achieve IT project goals.**

ITC05.02.01 Summarize the importance of cross-functional teams in achieving IT project goals.

Sample Indicators

- Consider the benefits of using a cross-functional team in policy and procedure development.
- Identify desired group and team behavior in an IT context.
- Explain technical concepts to various audiences in non-technical terms.

ITC05.02.02 Describe strategies for maximizing productivity in a high tech environment.

ITC05.03 **Employ project management knowledge to oversee IT projects.**

ITC05.03.01 Implement project methodologies to manage information system projects.

Sample Indicators

- Define the project's contribution to business needs.
- Define the scope of the project.
- Identify stakeholders and decision makers.
- Identify escalation procedures.
- Develop task list (work breakdown structures).
- Evaluate project requirements.
- Identify required resources and budget.
- Estimate time requirements.
- Develop initial project management flowchart.
- Identify interdependencies.
- Identify critical milestones.
- Evaluate risks.
- Prepare contingency plan.
- Manage the change control process.
- Track critical milestones.
- Participate in project phase review.
- Report project status.

Utilize project management software.
Develop a method of evaluation.

ITC05.03.02 Define scope of work to achieve individual and group goals.

Sample Indicators
- Assess the task's contribution to overall business needs.
- Identify size and specifics of the task.
- Formulate task sequence.
- Plan multiple tasks simultaneously.
- Identify potential problems.
- Develop contingency plans.

ITC05.03.03 Develop time and activity plans to achieve objectives.

Sample Indicators
- Coordinate plan with team, cross-functional groups, or individuals.
- Formulate a task strategy.
- Prioritize tasks according to business needs.
- Manage multiple tasks simultaneously.
- Devise plan of action.

Cluster Topic ITC06

SAFETY, HEALTH AND ENVIRONMENTAL: ***Understand the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. Follow organizational policies and procedures and contribute to continuous improvement in performance and compliance.***

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

Cluster Topic ITC07

LEADERSHIP AND TEAMWORK: ***Use leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.***

No additional statements in this topic beyond those found in the Essential Knowledge and Skills Chart.

Cluster Topic ITC08

ETHICS AND LEGAL RESPONSIBILITIES: ***Know and understand the importance of professional ethics and legal responsibilities.***

ITC08.01 Apply standard practices and behaviors that meet legal and ethical responsibilities and exhibit positive cyber-citizenry to understand legal issues faced by IT professionals.

ITC08.01.01 Explain legal issues faced by IT professionals.

Sample Indicators
- Demonstrate knowledge of the legal issues that face Information Technology professionals.
- Identify issues and trends affecting computers and information privacy.
- Explain legal issues involved in a company security policy.
- Identify legal issues involved concerning a security breach.

ITC08.01.02 Summarize the rights and responsibilities of IT workers.

ITC08.01.03 Identify ethical issues common to the IT field.

Cluster Topic ITC09

EMPLOYABILITY AND CAREER DEVELOPMENT: ***Know and understand the importance of employability skills. Explore, plan, and effectively manage careers. Know and understand the importance of entrepreneurship skills.***

Gap Analysis Tools

Corning Community College
CCTI Site Partnership Career Pathways Curriculum Alignment Gap Analysis
Information Technology
(two-page sample)

Following is a sample of the Corning Community College Information Technology Gap Analysis for CCTI. CCC developed a gap analysis tool to identify whether Knowledge and Skill Performance Elements were embedded in the curriculum at the various high schools and/or the community college. Further, CCC's A.L.I.G.N. template identifies to what degree the knowledge or skill is aligned.

CCC Gap Analysis provided by Linda Miller.

2005-2006- CCTI Deliverable #2
Career Pathways Curriculum Alignment- "Gap Analysis"
Information Technology- Corning Community College

TECH PREP

A – "Awesome"
L = "Looking good"
I = "Improving"
G = "Getting there"
N = "No alignment at all"

PATHWAY TOPIC		Knowledge & Skill (KS) Statement	Performance Element	Corning Community College					Campbell-Savona High School					GST BOCES (formerly SCT)					Watkins Glen High School				
				A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None					A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None					A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None					A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None				
				A	L	I	G	N	A	L	I	G	N	A	L	I	G	N	A	L	I	G	N
I.	Academic Found-ations (AF)	AF-1 *Demonstrates Language Arts knowledge and skills required to pursue the full-range of career and post-secondary education opportunities within the IT career cluster.*	-1-		X					X				X					X				
			-2-			X				X					X				X				
			-3-		X					X				X						X			
			-4-		X					X				X							X		
			-5-			X				X				X					X				
			-6-		X					X				X					X				
			-7-			X				X				X						X			
			-8-			X				X				X						X			
			-9-			X				X				X						X			
			-10-		X				X					X					X				
		AF-2 *Demonstrates Mathematics knowledge and skills required to pursue the full-range of career and post-secondary education opportunities within the IT career cluster.*	-1-	X						X				X					X				
			-2-	X					X					X					X				
			-3-	X						X				X					X				
			-4-		X					X				X					X				
			-5-	X						X				X					X				
			-6-	X						X				X					X				
			-7-		X					X					X					X			
			-8-	X						X				X					X				

PATHWAY TOPIC		Knowledge & Skill (KS) Statement	Performance Element	Corning Community College					Campbell-Savona High School					GST BOCES (formerly SCT)					Watkins Glen High School				
				A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None					A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None					A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None					A= 76%-100% L= 51%-75% I= 26%-50% G= 1%-25% N= None				
				A	L	I	G	N	A	L	I	G	N	A	L	I	G	N	A	L	I	G	N
II.	Communi-cations (C)	C-1 *Comprehend and use reading strategies to learn meaning, technical concepts, vocabulary, and follow instructions.*	-1-		X					X				X					X				
			-2-		X					X				X					X				
			-3-		X					X				X						X			
		C-2 *Locate, organize and reference written information from various sources to communicate with co-workers and clients/participants.*	-1-		X					X				X						X			
			-2-		X					X					X					X			
			-3-		X					X						X				X			
		C-3 *Use correct grammar, punctuation and terminology to write and edit documents.*	-1-		X					X				X					X				
			-2-	X						X				X					X				
			-3-	X						X				X					X				
			-4-	X					X					X					X				
		C-4 *Develop and deliver formal and informal presentations using appropriate media to engage and inform audiences.*	-1-	X						X				X					X				
			-2-	X						X					X				X				
			-3-		X					X					X				X				
		C-5 *Interpret verbal and nonverbal behaviors to enhance communication with co-workers and clients/participants.*	-1-		X					X				X					X				
			-2-		X					X				X					X				
		C-6 *Apply active listening skills to obtain and clarify information.*	-1-		X					X				X					X				
			-2-		X					X				X					X				

Gap Analysis Tools

Sinclair Community College
Ohio Competency Chart
Health Science Competency Chart
(one-page sample)

Your partnership may choose to gauge to what depth or degree the education provider—high school or community college—is teaching the knowledge or skill. The following sample of the Ohio Health Science Competency Chart codes whether secondary and postsecondary partners introduce, reinforce, or expect proficiency of various competencies. Business, industry and labor partners also validate each competency as essential or recommended (see key on chart).

For more detailed information, go to:
www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEDetail.aspx?page=3&TopicRelationID=1769&ContentID=15354&Content=79168.

2007 Health Science
Competency Chart

At the end of the secondary program (12) and associate degree (AD) each competency is coded: I = Introductory; P = Proficient; R = Reinforce. In addition, the business, industry, and labor partnership (BIL) validated each competency: BIL: E = Essential; R = Required

Competency		12	AD	BIL
Health Science Core Body of Knowledge				
Unit 1:	**Career Exploration, Development and Employability Traits**			
1.1	Explore health science careers.	P	R	E
1.2	Explore the academic foundation for health science careers.	P	R	E
1.3	Explain the responsibilities of a health care provider.	I	P	E
1.4	Complete required training, education, certification and professional development to keep abreast of relevant resources and current information.	I	P	E
1.5	Recognize the characteristics of team and team leadership.	I	R	R
1.6	Demonstrate positive work behaviors and personal qualities.	I	P	E
1.7	Demonstrate sensitivity to cultural values.	I	P	E
1.8	Employ problem solving and critical thinking.	I	P	E
1.9	Demonstrate common problem-solving skills used in health science.	I	P	E
Unit 2:	**Business Processes**			
2.1	Analyze the business structure of health science career fields.	I	R	R
2.2	Explain the impact of economic, social and technological changes on the health science/health care services.	I	R	R
2.3	Explain how planning and budgeting are used to accomplish organizational goals and objectives.	I	P	E
2.4	Demonstrate internal and external patient service techniques.	I	P	E
2.5	Design a business plan.	I	P	R
2.6	Explain basic procedures in the accounting cycle.	I	R	R
2.7	Explain the measures used by health organizations to manage and improve performance.		P	E
2.8	Demonstrate effective use of technology.	P	R	E
2.9	Demonstrate facility operational protocols.	P	R	E
Unit 3:	**Communication**			
3.1	Apply effective verbal and nonverbal communication skills.	P	R	E
3.2	Utilize available communication technology.	P	R	E
3.3	Interact with patient/client.	I	P	E
3.4	Convey essential patient/client information to appropriate team members.	I	P	E
3.5	Summarize Health Insurance Portability and Accountability Act (HIPAA).	I	P	E
3.6	Utilize basic medical terminology.	I	P	E
3.7	Locate, organize and reference written health science information from various sources.	P	R	E

Curriculum Alignment Tools

Bartholomew Consolidated School Corporation
Language Arts Spiraling by Standard Indictors (Grades 8 – 12, Language Arts Standards 1 and 4)
Columbus, IN
(two-page sample)

Spiraling by standards maps when and what knowledge or skill is taught at what grade or education level. Content is repeatedly reviewed and reinforced throughout the curriculum and builds on previous knowledge, becoming increasingly complex and sophisticated over time. Depth and difficulty increases with each grade level.

For more detailed information, go to:
www.bcsc.k12.in.us/158910108101710987/blank/browse.asp?A=383&BMDRN=2000&BCOB=0&C=59808.

Spiraling by Standard Indicators Across Grade Levels 8-12

Standard 1	Reading: Word Recognition, Fluency, and Vocabulary Development - Vocabulary and Concept Development				
	Eighth Grade	Ninth Grade	Tenth Grade	Eleventh Grade	Twelfth Grade
	8.1.1 Analyze idioms and comparisons — such as analogies, metaphors, and similes — to infer the literal and figurative meanings of phrases. • Idioms: expressions that cannot be understood just by knowing the meanings of the words in the expression, such as *to be an old hand at something* or *to get one's feet wet* • Analogies: comparisons of the similar aspects of two different things • Metaphors: implied comparisons, such as The stars were brilliant diamonds in the night sky. • Similes: comparisons that use like or as, such as *The stars were like a million diamonds in the sky.*	9.1.1 Identify and use the literal and figurative meanings of words and understand the origins of words.	10.1.2 Distinguish between what words mean literally and what they imply, and interpret what words imply.		
	8.1.2 Understand the influence of historical events on English word meaning and vocabulary expansion.	9.1.3 Use knowledge of mythology (Greek, Roman, and other mythologies) to understand the origin and meaning of new words.	10.1.3 Use the knowledge of mythology (Greek, Roman, and other mythologies) to understand the origin and meaning of new words.	11.1.2 Apply knowledge of roots and word parts from Greek and Latin to draw inferences about the meaning of vocabulary in literature or other subject areas.	12.1.2 Apply knowledge of roots and word parts from Greek and Latin to draw inferences about the meaning of vocabulary in literature or other subject areas.
	8.1.3 Verify the meaning of a word in its context, even when its meaning is not directly stated, through the use of definition, restatement, example, comparison, or contrast.	9.1.2 Distinguish between what words mean literally and what they imply and interpret what the words imply	10.1.4 Identify and use the literal and figurative meanings of words and understand origins of words.	11.1.3 Analyze the meaning of analogies encountered, analyzing specific comparisons as well as relationships and inferences.	12.1.3 Analyze the meaning of analogies encountered, analyzing specific comparisons as well as relationships and inferences.

Standard 4	Writing Processes and Features				
	Eighth Grade	Ninth Grade	Tenth Grade	Eleventh Grade	Twelfth Grade
Research Process and Technology	8.4.4 Plan and conduct multiple-step information searches using computer networks. 8.4.5 Achieve an effective balance between researched information and original ideas. 8.4.6 Use a computer to create documents by using word-processing skills and publishing programs; develop simple databases and spreadsheets to manage information and prepare reports.	9.4.4 Use writing to formulate clear research questions and to compile information from primary and secondary print or Internet sources. 9.4.5 Develop the main ideas within the body of the composition through supporting evidence, such as scenarios, commonly held beliefs, hypotheses, and definitions. 9.4.6 Synthesize information from multiple sources, including almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents, and Internet sources. 9.4.7 Integrate quotations and citations into a written text while maintaining the flow of ideas. 9.4.8 Use appropriate conventions for documentation in text, notes, and bibliographies, following the formats in specific style manuals. 9.4.9 Use a computer to design and publish documents by using advanced publishing software and graphic programs.	10.4.4 Use clear research questions and suitable research methods, including texts, electronic resources, and personal interviews, to compile and present evidence from primary and secondary print or Internet sources. 10.4.5 Develop main ideas within the body of the composition through supporting evidence, such as scenarios, commonly held beliefs, hypotheses, and definitions. 10.4.6 Synthesize information from multiple sources. Identify complexities and inconsistencies in the information and the different perspectives found in each medium, including almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents, and Internet sources. 10.4.7 Integrate quotations and citations into a written text while maintaining the flow of ideas. 10.4.8 Use appropriate conventions for documentation in text, notes, and bibliographies following the formats in different style manuals. 10.4.9 Use a computer to design and publish documents by using advanced	11.4.7 Develop presentations using clear research questions and creative and critical research strategies, such as conducting field studies, interviews, and experiments; researching oral histories; and using Internet sources. 11.4.8 Use systematic strategies to organize and record information, such as anecdotal scripting or annotated bibliographies. 11.4.9 Use a computer to integrate databases, pictures and graphics, and spreadsheets into word-processed documents. 11.4.13 Integrate quotations and citations into a written text while maintaining the flow of ideas.	12.4.7 Develop presentations using clear research questions and creative and critical research strategies, such as conducting field studies, interviews, and experiments; researching oral histories; and using Internet sources. 12.4.8 Use systematic strategies to organize and record information, such as anecdotal scripting or creating annotated bibliographies. 12.4.9 Use technology for all aspects of creating, revising, editing, and publishing. 12.4.13 Integrate quotations and citations into a written text while maintaining the flow of ideas.

Curriculum Alignment Tools

Bartholomew Consolidated School Corporation
Language Arts Unwrapped Standard—Core Maps for 12th Grade
Columbus, IN
(four pages organized by quarters)

Curriculum maps document and illustrate when and how key content and skills are delivered and assessed. Well-developed curriculum maps unpack or unwrap the standards to detail the sequence of classroom instruction, activities, and assignments that address various elements of the standards.

For more detailed information, go to:
www.bcsc.k12.in.us/158910108101710987/blank/browse.asp?A=383&BMDRN=2000&BCOB=0&C=59808.

Unwrapped Standards/Indicators (Core Map) 2009-2010
12th Grade

Quarter 1 **CS# - State Core Standard** **√ - Power Standard**

1	CS3	√	• Archetypes drawn from myth and tradition in literature, film, political speeches, and religious writings	• Evaluate the way in which authors incorporate archetypes into their writing	12.3.6
1	CS4 CS5	√	• Writing plans • Writing evaluation • Writing explanations and personal reactions	• Engage in conversations about planning, evaluating, explaining, and reacting to writing	12.4.1
1	CS4	√	• Presentations • Research questions • Research strategies • Field studies, interviews, experiments, oral histories, and Internet sources	• Develop presentations that incorporate information from research questions and strategies such as field studies, interviews, experiments, oral histories, and Internet sources	12.4.7
1	CS7	√	• Effective language • Interesting language • Informal expressions for effect • Standard English for clarity • Technical language for specificity	• Choose effective and interesting language such as informal expressions for effect, Standard English for clarity, and technical language for specificity	12.7.6

Quarter 2 **CS# - State Core Standard** **√ - Power Standard**

2	CS3	√	• Archetypes drawn from myth and tradition in literature, film, political speeches, and religious writings	• Evaluate the way in which authors incorporate archetypes into their writing	12.3.6
2	CS3	√	• Recognized works of world literature • Literary forms, techniques, and characteristics from literary periods • Major themes and issues of literary periods • Influences of a historical period on a given novel	• Analyze recognized works of world literature • Contrast literary forms, techniques, and characteristics from literary periods • Relate literary works and authors to major themes and issues of the time • Evaluate the influences of a historical period on a given novel	12.3.7
2	CS3	√	• Clarity and consistency of political assumptions in a selection of literary works or essays on a topic	• Evaluate the clarity and consistency of political assumptions in a selection of literary works or essays on a topic	12.3.8
2	CS4 CS5	√	• Writing plans • Writing evaluation • Writing explanations and personal reactions	• Engage in conversations about planning, evaluating, explaining, and reacting to writing	12.4.1
2	CS4	√	• Presentations • Research questions • Research strategies • Field studies, interviews, experiments, oral histories, and Internet sources	• Develop presentations that incorporate information from research questions and strategies such as field studies, interviews, experiments, oral histories, and Internet sources	12.4.7
2	CS4	√	• Research reports • Systematic research process • Variety of sources • Primary and secondary documents • Citations • Relevance • Summary of information • Refinement of topic • Conclusions • Synthesis of information • Accuracy, bias, and credibility • Data, charts, tables, and graphs • Classifying, categorizing, and sequencing one's own ideas from the ideas of others • Bibliography (Works Cited)	• Write or deliver a research report with the support of a systematic research process • Write or deliver a research report that incorporates a variety of sources including primary and secondary sources that are documented by citations • Write or deliver a research report that summarizes and synthesizes information and refines the topic • Evaluate sources for accuracy, bias, and credibility • Incorporate data, charts, tables, and graphs into the research report • Organize information by classifying, categorizing, and sequencing one's own ideas from the ideas of others • Document sources on a Works Cited page	12.5.10
2	CS7	√	• Effective language • Interesting language • Informal expressions for effect • Standard English for clarity • Technical language for specificity	• Choose effective and interesting language such as informal expressions for effect, Standard English for clarity, and technical language for specificity	12.7.6

Quarter 3 **CS# - State Core Standard** **√ - Power Standard**

3	CS3	√	• Archetypes drawn from myth and tradition in literature, film, political speeches, and religious writings	• Evaluate the way in which authors incorporate archetypes into their writing	12.3.6
3	CS3	√	• Recognized works of world literature • Literary forms, techniques, and characteristics from literary periods • Major themes and issues of literary periods • Influences of a historical period on a given novel	• Analyze recognized works of world literature • Contrast literary forms, techniques, and characteristics from literary periods • Relate literary works and authors to major themes and issues of the time • Evaluate the influences of a historical period on a given novel	12.3.7
3	CS4 CS5	√	• Writing plans • Writing evaluation • Writing explanations and personal reactions	• Engage in conversations about planning, evaluating, explaining, and reacting to writing	12.4.1
3	CS4	√	• Presentations • Research questions • Research strategies • Field studies, interviews, experiments, oral histories, and Internet sources	• Develop presentations that incorporate information from research questions and strategies such as field studies, interviews, experiments, oral histories, and Internet sources	12.4.7
3	CS4	√	• Research reports • Systematic research process • Variety of sources • Primary and secondary documents • Citations • Relevance • Summary of information • Refinement of topic • Conclusions • Synthesis of information • Accuracy, bias, and credibility • Data, charts, tables, and graphs • Classifying, categorizing, and sequencing one's own ideas from the ideas of others • Bibliography (Works Cited)	• Write or deliver a research report with the support of a systematic research process • Write or deliver a research report that incorporates a variety of sources including primary and secondary sources that are documented by citations • Write or deliver a research report that summarizes and synthesizes information and refines the topic • Evaluate sources for accuracy, bias, and credibility • Incorporate data, charts, tables, and graphs into the research report • Organize information by classifying, categorizing, and sequencing one's own ideas from the ideas of others • Document sources on a Works Cited page	12.5.10
3	CS7	√	• Effective language • Interesting language • Informal expressions for effect • Standard English for clarity • Technical language for specificity	• Choose effective and interesting language such as informal expressions for effect, Standard English for clarity, and technical language for specificity	12.7.6

Quarter 4 **CS# - State Core Standard** **√ - Power Standard**

4	CS3	√	• Archetypes drawn from myth and tradition in literature, film, political speeches, and religious writings	• Evaluate the way in which authors incorporate archetypes into their writing	12.3.6
4	CS4 CS5	√	• Writing plans • Writing evaluation • Writing explanations and personal reactions	• Engage in conversations about planning, evaluating, explaining, and reacting to writing	12.4.1
4	CS4	√	• Presentations • Research questions • Research strategies • Field studies, interviews, experiments, oral histories, and Internet sources	• Develop presentations that incorporate information from research questions and strategies such as field studies, interviews, experiments, oral histories, and Internet sources	12.4.7
4	CS7	√	• Effective language • Interesting language • Informal expressions for effect • Standard English for clarity • Technical language for specificity	• Choose effective and interesting language such as informal expressions for effect, Standard English for clarity, and technical language for specificity	12.7.6

Curriculum Alignment Tools

Miami-Dade County Public Schools
12th Grade English District Pacing Guide (week 1—three pages; week 39—three pages)
Miami, FL

Pacing guides outline when and how concepts, topics, and skills are sequenced during the duration of a particular class or curriculum.

For more detailed information, go to:
http://curriculum_materials.dadeschools.net/pacing_guides/.

MIAMI-DADE COUNTY PUBLIC SCHOOLS
District Pacing Guide

English 4: 12th Grade **Course Code:** 100140001

STRAND/BODY OF KNOWLEDGE: **Reading Process, Literary Analysis, Writing Process, Writing Applications, Communication, Information and Media Literacy**

TOPIC I: The Epic – The Art of Storytelling: Connecting Literary Elements

Pacing
5 Days Week 1 08/23/10-08/27/10

Next Generation Sunshine State Standards	ESSENTIAL CONTENT	OBJECTIVES	INSTRUCTIONAL TOOLS
LA.1112.2.1 The student identifies, analyzes, and applies knowledge of the elements of a variety of fiction and literary texts to develop a thoughtful response to a literary selection. LA.1112.2.1.8 The student will explain how ideas, values, and themes of a literary work often reflect the historical period in which it was written. LA.1112.2.1.2 The student will analyze and compare a variety of traditional, classical, and contemporary literary works, and identify the literary elements of each (e.g.,setting, plot, characterization, conflict). LA.1112.1.6 The student uses multiple strategies to develop grade appropriate vocabulary. LA.1112.1.6.2 The student will listen to, read, and discuss familiar and conceptually challenging text.	<u>Literary Analysis</u> • understand and appreciate elements of an epic • understand and identify characteristics of an epic hero • identify elements of setting, character, and plot <u>Reading Process</u> • utilize brainstorming, predictions, and generate questions <u>Grammar component:</u> • review and identify the parts of speech <u>Oral Process</u> • utilize effective strategies for informal and formal discussions <u>Writing Process/Application:</u> • use prewriting strategies to generate ideas and formulate a plan. • write a draft of a descriptive essay appropriate to the topic, audience,	The student will: • identify details of Beowulf's responses to challenges in the readings. • explain how Beowulf's identification of himself corresponds to a warrior culture. • make a thematic connection with ***Beowulf*** and the ***Iliad*** • paraphrase identified sentences describing combat • respond to (in writing) content based questions • in ongoing classroom discussions listen, share, and expound upon plot, character, and thematic discourse • plan and compose a descriptive essay, incorporating sensory language. • develop the writing trait of *ideas* (focus and support) within the essay.	<u>Core Text Book</u>: Prentice Hall The British Tradition –p.39 Holt Elements of Literature 6th Course – p.18 McDougal Littell The Language of Literature – p.30 Glencoe –p.48 ***Beowulf*** "The Wrath of Grendel" "The Coming of Beowulf" "The Battle with Grendel" Excerpt from the ***Iliad*** <u>Vocabulary:</u> • Text suggested vocabulary • epic, elements of an epic <u>Other Recommended Novels/Readings:</u> ***Lord of the Rings Trilogy*** – J.R.R. Tolkien ***The Iliad*** - Homer ***The Odyssey*** – Homer ***Doctor Faustus*** – Christopher Marlowe ***Ivanhoe*** – Sir Walter Scott ***Hamlet*** – William Shakespeare <u>Technology:</u>

MIAMI-DADE COUNTY PUBLIC SCHOOLS
District Pacing Guide

English 4: 12th Grade **Course Code:** 100140001

STRAND/BODY OF KNOWLEDGE: **Reading Process, Literary Analysis, Writing Process, Writing Applications, Communication, Information and Media Literacy**

LA.1112.1.6.3 The student will use context clues to determine meanings of unfamiliar words. LA.1112.1.7 The student uses a variety of strategies to comprehend grade level text. LA.1112.1.7.1 The student will use background knowledge of subject and related content areas, prereading strategies (e.g., previewing, discussing, generating questions), text features, and text structure to make and confirm complex predictions of content, purpose, and organization of a reading selection. LA.1112.3.1.1 The student will prewrite by generating ideas from multiple sources (e.g., prior knowledge, discussion with others, writer's notebook, research materials, or other reliable sources), based upon teacher-directed topics and personal interests. LA.1112.3.2.2 The student will draft writing by establishing a logical organizational pattern with supporting details that are substantial, specific, and relevant.	and purpose. • develop and demonstrate creative writing.		Riverdeep: Unit Plans English IV Grade 12 #1-10 http://village2.dadeschools.net lv/ http://languageartsreading.dadeschools.net / http://www. classzone.com – Mcdougal Littell support http://go.hrw.com – Holt online site http://www.thinkcentral.com – Holt support

MIAMI-DADE COUNTY PUBLIC SCHOOLS
Instructional Focus Calendar

English 4: 12th Grade **Course Code:** 100140001

STRAND/BODY OF KNOWLEDGE: **Reading Process, Literary Analysis, Writing Process, Writing Applications, Communication, Information and Media Literacy**

Date	Pacing Guide Benchmark(s)	Data Driven Benchmark(s)	Activities	Assessment(s)	Strategies
08/23/10-08/27/10					

MIAMI-DADE COUNTY PUBLIC SCHOOLS
District Pacing Guide

English IV - Grade 12 **Course Code: 100140001**

STRAND/BODY OF KNOWLEDGE: Reading Process, Literary Analysis, Writing Process, Writing Applications, Communication, Information and Media Literacy

TOPIC: Final Exams

Pacing	Date
3 days	06/07/10– 06/09/10 Week: 39

Sunshine State Standards (Benchmarks)	ESSENTIAL CONTENT	OBJECTIVES	INSTRUCTIONAL TOOLS	New Sunshine State Standards (Benchmarks)
LA.C.1.4.1. The student selects and uses appropriate listening strategies according to the intended purpose.	Literary Analysis: • Review/Recall for final exams Reading Process: • Review/Recall for final exams Grammar: ▪ subject	The student will: • Review for and take final exams Final exams—no writing required. • Last week of school—no writing required	Core Text Book: Prentice Hall The British Tradition – Holt Elements of Literature 6th Course – McDougal Littell The Language of Literature – Glencoe – Vocabulary: • Teacher generated vocabulary Other Recommended Novels/Readings ***All Quiet on the Western Front*** (Erich Maria Remarque) ***Things Fall Apart*** (Chinua Achebe) ***Heart of Darkness*** (Joseph Conrad) ***1984*** (George Orwell) ***2001: A Space Odyssey*** (Arthur C. Clarke) ***Siddhartha*** (Hermann Hesse)	LA.1112.2.1.1 The student will] analyze and compare historically and culturally significant works of literature, identifying the relationships among the major genres (e.g., poetry, fiction, nonfiction, short story, dramatic literature, essay) and the literary devices unique to each, and analyze how they support and enhance the theme and main ideas of the text; LA.1112.2.1.2 The student will] analyze and compare a variety of traditional, classical, and contemporary literary works, and identify the literary elements of each (e.g., setting, plot, characterization, conflict).

MIAMI-DADE COUNTY PUBLIC SCHOOLS
District Pacing Guide

English IV - Grade 12 **Course Code: 100140001**

STRAND/BODY OF KNOWLEDGE: Reading Process, Literary Analysis, Writing Process, Writing Applications, Communication, Information and Media Literacy

Sunshine State Standards (Benchmarks)	ESSENTIAL CONTENT	OBJECTIVES	INSTRUCTIONAL TOOLS	New Sunshine State Standards (Benchmarks)
			Technology: http://languageartsreading.dadeschools.net/ http://www. classzone.com – Mcdougal Littell support http://go.hrw.com – Holt online site http://www.thinkcentral.com – Holt support George Orwell link http://www.netcharles.com/orwell/essays.htm	

MIAMI-DADE COUNTY PUBLIC SCHOOLS
Instructional Focus Calendar

English IV - Grade 12 Course Code: 100140001

STRAND/BODY OF KNOWLEDGE: Reading Process/Writing Process/Literary Analysis

Date	Pacing Guide Benchmark(s)	Data Driven Benchmark(s)	Activities	Assessment(s)	Strategies
06/07/10–06/09/10	LA.C.1.4.1. The student selects and uses appropriate listening strategies according to the intended purpose.				

Curriculum Alignment Tools

Ponitz Career and Technical Center/Sinclair Community College
Biotechnology (11th and 12th grade) Year-long Pacing Guides
Dayton, OH

This an effective example of a pacing guide that maps across educational levels. In this year-long pacing guide, a detailed map links the K-12 curriculum to the appropriate college courses.

PCTC/SCC Pacing Guide provided by Ron Kindell.

Teacher: Joshua Roark

Sinclair Faculty: Angie Currier

Class: Biotechnology (11th Grade)

PCTC/Sinclair Pacing Guide

E.D. = Ellyn Daugherty Text/Lab Book
BioRad = Labs from BioLab Manual
All labs are Inquiry Based (Writing Lab Reports)

2010 – 2011

Weeks	Career Technical Competencies Reference	Academic Curriculum Reference	Activities/Blue Prints	Content/Project Based (√)	College Connection *(credit, event, faculty support, use of Sinclair Equipment)*	Major Materials + Equipment
Week 1	**Exploring Biotechnology + Industry (unit 49)** ***Sc. Mth./Exp. (34, 35)***	**Communications E (11,12)**	**Syllabi, *Reviewing Rules and Regulations*, Who Am I Powerpoint, *Biotechnology Review*, Chemistry Demos**	**2 lecture slideshows, Student powerpoint presentation, 3 activities, teacher demos** ***Inquiry-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110**	**Paper Based Materials, Chemicals, Glassware, Table Top Balances**
Week 2	**Laboratory Safety, Chemical Materials & Chemical Handling (35.0/ 36.1 – 36.6)** ***Chemical Materials Handling & Biohazard Storage (38.1 – 38.2.7 & 40.1 – 40.3.10)*** **Conducting Experiments Review (35.1 – 35.3)** ***Scientific Method Review (34.1.1 – 34.2.3)***	**Writing Applications D (11,12) Reading Process B (8 - 12) Reading Process- C (8-10) Research- B (11,12) Math Data Analysis A (11,12), F (8-10) Math Processes- B (11,12) Science Inquiry- A (9,10) Government- A (11,12) Social Studies Skills A (11,12)**	**Chemical Safety + Handling Slideshow, *Biohazard Storage Slideshow*, Conducting Experiments and Scientific Method Slideshow (Review), *and Labs***	**daily quizzes, 3 slideshows, teacher demos, 5 day lab, student teach-backs** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110**	**Lab Tops, Acids/Bases (Chemicals), Pipet Pumps, Glassware, Analytical Balance, Table Top Balances, Magnetic Machines, pH Meter Machines, Thermometers**

Week 3	**Concepts of Measurement (39.1.1 – 39.1.12)** ***Pipeting & Analytical Balance Skills (37.1.1, 2, 4)*** **Chem. Lab Skills (42.2, 3, 4)** ***Micro-Centrifuging (37.3)*** **Chemical Calculations (38.1.8) (42.1, 2, 7, 8)**	**Vocabulary- D (11,12) Vocabulary Acquisition F, E (8 - 12) Math- Measurement D, E (8 – 10) A, B (11 – 12) Math-Data/Probability D (8-10)**	**Knowing Your Equipment Slideshow, *Preparing Solutions and Different Concentrations Slideshow* *E.D.*: Chpt. 3**	**daily quizzes, 3 slideshows, 5 day lab, student teach-backs *Web-Based***	**BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Pipet Pumps, Micropipets, Table Top Balances, Magnetic Machines, Microcentrifuges,**
Week 4	**Chemistry Content *A*** **Physical + Chemical Properties (38.1.1 – 38.1.3)** ***Sc. Mth./Exp. (34, 35)***	**Vocabulary- D (11,12) Vocabulary Acquisition F, E (8 – 12) Algebra- D (8-10) Physical Science A, B, C, F (9-10) Physical Science A (11,12)**	**Role of Chemistry Slideshow,** ***Physical/Chemical Properties Lab,***	**daily quizzes, 1 lecture slideshow, 3 day lab,** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 CHE 131 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Glassware, Table Top Balances, Magnetic Machines, Thermometers**
Week 5	**Chemistry Content *B*** **Characterizing Physical Properties (g, l, s) (39.2.1 – 39.2.7)** ***Sc. Mth./Exp. (34, 35)***	**Math Measurement- A (11,12) Math Algebra- I (8 – 10) Physical Science- C (9,10)**	**States of Matter Slideshow, *Law Lab*, Teacher Demos**	**daily quizzes, 1 lecture slideshow, 5 day lab, teacher demos *Inquiry-Based*** ***Web-Based***	**ENG 111-112 CHE 131 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Dry Ice, Canisters, Glassware, Table Top Balances, Magnetic Machines**
Week 6	**Chemistry Content *C*** **Atomic Structure (38.1.4 – 38.1.6)** ***Sc. Mth./Exp. (34, 35)***	**Vocabulary- D (11,12) Vocabulary Acquisition F, E (8 – 12) Algebra- D (8-10) Physical Science A, B, C, F (9-10) Physical Science A (11,12)**	**Atomic Structure Slideshow, *Atomic Structure Art Project*, Bohr Theory Slideshow, *Electron Configuration Drawing Project* and Worksheets**	**daily quizzes, 2 lecture slideshows, 2 projects, 2 worksheets, and many student drawings** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 CHE 131 COM 225 BTN 120 BTN 110**	**Lab Tops, Periodic Tables, Project Materials**

Week 7	**Chemistry Content *D*** **Bohr Theory** **(38.1.4 – 38.1.6)** ***Sc. Mth./Exp. (34, 35)***	**Vocabulary- D** **(11,12)** **Vocabulary Acquisition** **F, E (8 – 12)** **Algebra- D (8-10)** **Physical Science** **A, B, C, F (9-10)** **Physical Science A** **(11,12)**	**Bohr Theory Slideshow Review, *Bohr Theory Drawings,* Poisonous Metals Lab**	**daily quizzes, student drawings, 5 day lab (student unknowns)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **COM 225** **BTN 120** **BTN 110**	**Lab Tops, Chemicals, Table Top Balances, Glassware, Magnetic Machines, Bunsen Burners**
Week 8	**Chemistry Content *E*** **Cation/Anion Discovery** **(38.1.7, 38.1.13)** ***Sc. Mth./Exp. (34, 35)***	**Vocabulary D** **(11,12)** **Vocabulary Acquisition** **F, E (8 – 12)** **Algebra D (8-10)** **Physical Science** **A, B, C, F (9-10)** **Physical Science A** **(11,12)**	**Concept Overview Slideshow, *Cation/Anion Lab,* Anion/Cation Art Project, *Worksheets,* and Reviewing Test**	**daily quizzes, 1 slideshow, 4 day lab (student unknowns), art project and 2 worksheets over naming chemicals** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **COM 225** **BTN 120** **BTN 110**	**Lab Tops, Chemicals, Table Top Balances, Glassware, Magnetic Machines**
Week 9	**Chemistry Content *F*** ***Chemical Reactions, Balancing, Stoichiometry,*** **(38.1.9 – 38.1.12)** ***Endothermic/Exothermic (38.1.20)*** **Sc. Mth./Exp. (34, 35)**	**Vocabulary- D** **(11,12)** **Vocabulary Acquisition** **F, E (8 – 12)** **Algebra- D (8-10)** **Physical Science** **A, B, C, F (9-10)** **Physical Science A** **(11,12)**	**Atomic Structure & Bonding Test, *Chemical Reactions and Balancing Slideshow,* Chemical Reactions Lab, *Teacher Demos***	**1 test, daily quizzes, 1 slideshow, 4 day lab, (student unknowns) balancing + endo./exothermic worksheets, teacher demos** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **COM 225** **BTN 120** **BTN 110**	**Lab Tops, Chemicals, Table Top Balances, Glassware, Magnetic Machines**
Week 10	**Chemistry Content G** ***Chemical Reactions, Balancing, Stoichiometry, (38.1.9 – 38.1.12)*** **Sc. Mth./Exp. (34, 35)**	**Vocabulary- D** **(11,12)** **Vocabulary Acquisition** **F, E (8 – 12)** **Physical Science C, F** **(9,10)**	**Precipitant Slideshow, Precipitant Lab**	**daily quizzes, 1 slideshow, 5 day lab, student unknowns** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **COM 225** **BTN 120**	**Lab Tops, Chemicals, Table Top Balances, Glassware, Magnetic Machines**

Week 11	**Chemistry Content *H*** ***Writing Hydrocarbon Compounds*** ***(38.1.14 – 38.1.17)*** **Chemical Nomenclature for Organic/Inorganic Compounds** **(38.2.4 – 38.2.7)**	**Vocabulary- D** **(11,12)** **Vocabulary Acquisition** **F, E (8 – 12)** **Physical Science- A** **(9, 10)**	**Chemical Nomenclature Slideshow, *Functional Groups Slideshow*, IUPAC Worksheets, *Flashcards*, Hydrocarbon Models**	**daily quizzes, 2 slideshows, flashcards, worksheets, student models** ***Web-Based***	**CHE 131**	**Lab Tops, 3 - dimensional building units for models**
Week 12	Chemistry Content *I* **Spectrophotometer** **(37.5.1 – 37.5.6)** ***Adjusting pH Solutions*** ***(37.1.3, 42.1.5)*** **Sc. Mth./Exp. (34, 35)**	**Math Algebra- C, D** **(8 – 10)** **Physical Science- G** **(9,10)**	**Spectrophotometer Slideshow, *pH Slideshow*, Making Buffers Slideshow,** **E.D.: Chpt. 7**	**daily quizzes, 3 slideshows, 5 day lab, student unknowns** ***Inquiry-Based*** ***Web-Based***	**CHE 131** **BTN 110** **MAT 106**	**Lab Tops, Chemicals, Biological Samples, Table Top Balance Spectrophotometers, pH paper, pH meter machines**
Week 13	**Chemistry Content J** **Explain, Interpret, Run, + Evaluate Chromatograms (45.1, 45.2, 45.3, 45.4)** ***Sc. Mth./Exp. (34, 35)***	**Vocabulary Acquisition D (11,12)** **Writing Applications- D** **(11,12)** **English Research- E** **(8 – 12)** **Physical Science- B, C** **(9,10)** **Scientific Inquiry- A** **(9 – 12)**	**Chromatography Slideshow, *Drug Analysis Slideshow*, Chromatography Lab**	**daily quizzes, 2 slideshows, 5 day lab, student unknowns** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **COM 225** **BTN 120** **BTN 110** **MAT 106**	**Lab Tops, Chemicals, Glassware, Glass Plates, Electrophoresis Machines, Fume-hood**
Week 14	**Chemical Reactions/Endothermic rxn (38.1.11, 38.1.20)** ***Proficiency in Microscopes*** ***(37.4.1 – 37.4.3)*** **Operating Compound Microscopes (41.3.1)** ***Sc. Mth./Exp. (34, 35)***	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A** **Life Sciences- A**	**Blood Analysis Slideshow, *Fiber Analysis Slideshow*, Blood and Fiber Labs**	**daily quizzes, 2 slideshows, 5 day lab, student unknowns** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **BIO 111-113** **COM 225** **BTN 120** **BTN 110**	**Lab Tops, Chemicals, Fibers, Glassware, Compound Microscopes, Table Top Balances, Analytical Balance**
Week 15	**Chemical Reactions (38.1.11, 38.1.20)** ***Proficiency in Microscopes*** ***(37.4.1 – 37.4.3)*** **Operating Compound Microscopes (41.3.1)** ***Sc. Mth./Exp. (34, 35)***	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A** **Life Sciences- A**	**Fingerprint Analysis Slideshows,** ***Fingerprint Lab***	**daily quizzes, 2 slideshows, 5 day lab, student unknowns** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112** **CHE 131** **COM 225** **BTN 120** **BTN 110**	**Lab Tops, Chemicals, Powders, Brushes, UV lights, UV machine, Glassware, Compound Microscopes, Table Top Balances**

Week 16	**Isolate + Characterize DNA (43.4.1, *3, 4, 5, 6, 7*)** **Reference BioRad Kit-Competencies** ***Sc. Mth./Exp. (34, 35)***	**Life Sciences- A (11,12) Physical Science- A, B (9,10)**	***Forensics Test,* Faces 4.0 Slideshow, *Faces Computer Lab,* Dna Profiling Slideshow,** **(*Dna Fingerprinting Kit*) *"BioRad"***	***Forensics Test,* daily quizzes, 5 day lab (Faces 4.0),** ***BioRad Kit-Dna Profiling Lab Student Unknowns*** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BIO 111-113 BTN 230 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, (Faces 4.0 software), Chemicals, Glassware, Electrophoresis Machines, Micropipets, Microcentrifuge Machines, Water Bath, Rocking Platform, UV Machine**
Week 17	***REVIEW ALL COMPETENCIES***	***REVIEW ALL CONTENT STANDARDS***	***REVIEW ALL LABS + MATERIALS FOR FINAL EXAM***	***REVIEW ALL LABS + MATERIALS FOR FINAL EXAM***	**CHE 131 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106**	**All Machinery Since Week 1**
Week 18	**Forensic Crime Scene A** **Final Exam Week 1** ***Reference all Competencies Since Week 1*** **Formal Presentations (3.9) Core Competencies**	***Reference All Standards Since Week 1***	**FINAL EXAM** **Student teams are assigned, crime scene visited, unknowns to determine the suspect(s), victim(s), where, when, why, how**	**Project Based** **√** ***(Radio/T.V.) (English)*** ***(Graphics)*** ***(Mathematics)*** ***(History)*** ***Inquiry-Based***	**ENG 111-112 CHE 131 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Glassware, Chemicals, Microcentrifuge Machines, Brushes, Analytical + Table Top Balances, Compound Microscopes, Water Baths, Rocking Platform, Electrophoresis Machines**
Week 19	**Forensic Crime Scene B** **Final Exam Week 2** ***Reference all Competencies Since Week 1*** **Formal Presentations (3.9) Core Competencies**	***Reference All Standards Since Week 1***	**FINAL EXAM** **Student teams are assigned, crime scene visited, unknowns to determine the suspect(s), victim(s), where, when, why, how**	**Project Based** **√** ***(Radio/T.V.) (English)*** ***(Graphics)*** ***(Mathematics)*** ***(History)*** ***Inquiry-Based***	**ENG 111-112 CHE 131 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Glassware, Chemicals, Microcentrifuge Machines, Brushes, Analytical + Table Top Balances, Compound Microscopes, Water Baths, Rocking Platform, Electrophoresis Machines**

Week 20	***Chemical Energy + Transport (47.2 3)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A Life Sciences- A**	***Plant Growth/Structure, Cells, Tissues, Organs, Meristematic Tissue, Plant Dna, Mitosis + Growth Slideshow,*** **Botany Slide Lab, Seed + Flower Dissection Lab** ***E.D.: Chpt. 10a – 10c***	**daily quizzes, 2 slideshows, 5 day lab** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110**	**Lab Tops, Compound Microscopes, Analytical Balance, Dissecting Microscopes, Fast Plants Material**
Week 21	***Genetics/Heredity (43.1)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A Life Sciences- A**	***Alternation of Generations, Genotype/Phenotypes Slideshows,*** **Breeding Plants Labs (5 week ending results)** **E.D.: Chpt. 10d – 10e**	**daily quizzes, 2 slideshows, 2 labs (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Compound Microscopes, Analytical Balance, Dissecting Microscopes, Fast Plants Materials Plant Light System**
Week 22 Part 1	***Genetics/Heredity (43.1)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	***Math- F, H, J, K (8 – 10)*** **Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A Life Sciences- A**	**Selective Breeding + Punnett Squares, 10% Rule, Standard Deviation, Chi Square Analysis Slideshows,** ***Asexual Reproduction Labs*** **E.D.: Chpt. (11a – 11b)**	**daily quizzes, 3 slideshows, 2 labs (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Compound Microscopes, Analytical Balance, Dissecting Microscopes, Fast Plants Materials, Plant Light System**
Week 23 Part 2	***Genetics/Heredity (43.1)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	***Math- F, H, J, K (8 – 10)*** **Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A Life Sciences- A**	**Selective Breeding + Punnett Squares, 10% Rule, Standard Deviation, Chi Square Analysis Slideshows,** ***Asexual Reproduction Labs*** **E.D.: Chpt. (11a – 11b)**	**daily quizzes, 3 slideshows, 2 labs (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Compound Microscopes, Analytical Balance, Dissecting Microscopes, Fast Plants Materials, Plant Light System**
Week 24	**Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A Life Sciences- A**	**Asexual Plant Propagation, Plant Tissue Culture, Plant Hormones, Maintaining Cultures Slideshows,** ***Plant Tissue Culture + Plant Hormones Lab*** **E.D.: Chpt. (11c)**	**daily quizzes, 4 slideshows, 1 lab (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Compound Microscopes, Analytical Balance, Dissecting Microscopes, Fast Plants Materials, Plant Light System**

Week 25 Part 1	**Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A** Life Sciences- A	***Plant Test,*** **Selective Breeding, Inbreeding, Genetic Testing, GMO's, Hydroponics, Plant Pharmaceuticals Slideshows,** ***Cloning African violets, + hydroponics Labs*** **E.D.: Chpt. (11d – 11e)**	**Plant Test, daily quizzes, 4 slideshows, 2 labs (5 days)** ***Inquiry-Based Web-Based***	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Biological Organisms, Chemicals, Glassware, Cloning Tools, pH Meters, Flow Hood, Pipet Pumps, Table Top Balances, Autoclave, Plant Light System**
Week 26 Part 2	**Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A** Life Sciences- A	***Plant Test,*** **Selective Breeding, Inbreeding, Genetic Testing, GMO's, Hydroponics, Plant Pharmaceuticals Slideshows,** ***Cloning African violets, + hydroponics Labs*** **E.D.: Chpt. (11d – 11e)**	**Plant Test, daily quizzes, 4 slideshows, 2 labs (5 days)** ***Inquiry-Based Web-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Biological Organisms, Chemicals, Glassware, Cloning Tools, pH Meters, Flow Hood, Pipet Pumps, Table Top Balances, Autoclave, Plant Light System**
Week 27 Part A	***Isolating Plant Dna (43.4.1)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)** ***Spectrophotometer (37.5.1 – 37.5.6)***	**Math Algebra- C, D (8 – 10)** ***Physical Science- A, B (9,10) G (9, 10)*** **Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A** Life Sciences- A	**Isolating/Characterizing Plant Dna Slideshow** **Dna concentration/Purity Assays Labs** **E.D.: Chpt. (11f – 11h)**	**daily quizzes, 1 slideshow, 2 labs (5 days)** ***Inquiry-Based Web-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Glassware, Pipet Pumps, Micropipets, Electrophoresis Machines, Water Baths, Table Top Balances, Spectrophotometer Machines, Biological Organisms**
Week 28 Part B	***Isolating Plant Dna (43.4.1)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** Sc. Mth./Exp. (34, 35) ***Spectrophotometer (37.5.1 – 37.5.6)***	**Math Algebra- C, D (8 – 10)** ***Physical Science- A, B (9,10) G (9, 10)*** **Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A** Life Sciences- A	**Isolating/Characterizing Plant Dna Slideshow** **Dna concentration/Purity Assays Labs** **E.D.: Chpt. (11i)**	**daily quizzes, 1 slideshow, 2 labs (5 days)** ***Inquiry-Based Web-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Glassware, Pipet Pumps, Spectrophotometer Machines, Table Top Balances, Biological Organisms**

Week 29	***Chemical Energy + Transport (47.2 3)*** **Microscope Analysis (37.4)** ***Laboratory Skills + Measurements (42.3, 42.5)*** **Sc. Mth./Exp. (34, 35)**	**Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- A Life Sciences- C, J (9,10) A, C (11-12)**	***Cross Breeding Slideshow Review,*** **Finish Plant Breeding Lab** ***(Genotypes)*** ***E.D.: Chpt. 10d – 10e***	**daily quizzes, 1 slideshow, 1 Lab (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Compound Microscopes, Analytical Balance, Dissecting Microscopes, Biological Organisms, Fast Plants Materials, Plant Light System**
Week 30 Part 1	***Isolating Plant Dna (43.4.1)*** **Laboratory Skills + Measurements (42.3 - 42.5)** ***Sc. Mth./Exp. (34, 35)***	**Math Algebra- C, D (8 – 10)** ***Physical Science- A, B (9,10) G (9, 10)*** **Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- Life Sciences- C, J (9,10) A, C (11-12)**	**Modifying Dna** ***(Agrobacterium/Ti plasmid)*** **Arabidopsis Organism Slideshows,** ***GMO's/Plant Transformation/Arabidopsis Lab (Biotech Live + Bioethics)*** **E.d.: Chpt. (11g – 11h)**	**daily quizzes, 2 slideshows, 1 lab (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BTN 230 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Glassware, Bunsen Burners, Flow Hood, Autoclave, Biological Organisms**
Week 31 Part 2	***Isolating Plant Dna (43.4.1)*** **Laboratory Skills + Measurements (42.3 - 42.5)** ***Sc. Mth./Exp. (34, 35)***	**Math Algebra- C, D (8 – 10)** ***Physical Science- A, B (9,10) G (9, 10)*** **Scientific Inquiry- A** ***Scientific Ways of Knowing B (6) C (8-11)*** **Science + Technology- Life Sciences- C, J (9,10) A, C (11-12)**	**Modifying Dna** ***(Agrobacterium/Ti plasmid)*** **Arabidopsis Organism Slideshows,** ***GMO's/Plant Transformation/Arabidopsis Lab (Biotech Live + Bioethics)*** **E.d.: Chpt. (11g – 11h)**	**daily quizzes, 2 slideshows, 1 lab (5 days)** ***Inquiry-Based*** ***Web-Based***	**ENG 111-112 BTN 230 COM 225 BTN 120 BTN 110 MAT 106**	**Lab Tops, Chemicals, Glassware, Bunsen Burners, Flow Hood, Autoclave, Biological Organisms**

Week 32	**Characteristics and Principles of Water (16.1.1, 2) (5.2.3, 6, 7) Identify Water Sampling Techniques (16.2.4, 5) Technical Writing + Documentation (50.1 – 50.5)** ***Formal Presentations (3.9) Core Competencies***	**Math Measurement-B (11, 12) Math Processes-B (8 – 10) Earth and Space-C (11. 12) D (9, 10) Life Sciences- B C (11, 12) D F (9, 10) Scientific Inquiry- A (11, 12) Physical Science- C (9,10)**	**River Habitat Slideshows x 5** ***Habitat Evaluation Index Test***	**Project Based (Radio/T.V.) (English) + (History)** √ ***Inquiry-Based Web-Based***	**ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Lab Tops, River Boots, Habitat Scientific Journals, Habitat Equipment**
Week 33 Part 1	**Conducting Research + Experiments (34, 35)** ***Characteristics and Principles of Water (16.1.3, 4, 6, 7, 9)*** **Identify Water Sampling Techniques (16.2.1, 2, 3, 4, 7, 9, 10, 11)** ***Constituents of Water (16.4.1, 2, 3, 4)*** **Analyzing Water (16.5.1, 2, 5, 6, 8) (5.2.1, 2) Technical Writing/Documentation (unit 50)**	**Math Measurement-B (11, 12) Math Processes-B (8 – 10) Earth and Space-C (11. 12) D (9, 10) Life Sciences- B C (11, 12) D F (9, 10) Scientific Inquiry- A (11, 12) Physical Science- C (9,10)**	**Chemical Slideshows,** **Outdoor River Testing** ***(DO, Turbidity, Nitrate, Phosphate, Ammonia, pH, conductivity, + TDS)*** ***"color-metric, titrations, and spectrophotometer"***	**Project Based (Radio/T.V.) (English) + (History)** √ ***Inquiry-Based Web-Based***	**CHE 131 ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Lab Tops, Chemical Test Kits, DO Meter, pH/conductivity/TDS Meters, BOD-5 Glassware, Turbidity Tubes, and a Spectrophotometer**
Week 34 Part 2	**Conducting Research + Experiments (34, 35)** ***Characteristics and Principles of Water (16.1.3, 4, 6, 7, 9)*** **Identify Water Sampling Techniques (16.2.1, 2, 3, 4, 7, 9, 10, 11)** ***Constituents of Water (16.4.1, 2, 3, 4)*** **Analyzing Water (16.5.1, 2, 5, 6, 8) (5.2.1, 2) Technical Writing/Documentation (unit 50)**	**Math Measurement-B (11, 12) Math Processes-B (8 – 10) Earth and Space-C (11. 12) D (9, 10) Life Sciences- B C (11, 12) D F (9, 10) Scientific Inquiry- A (11, 12) Physical Science- C (9,10)** ***Formal Presentations (3.9) Core Competencies*** ←	**Chemical Slideshows,** **Outdoor River Testing** ***"chemical testing using 2800 spectrophotometer"***	**Project Based (Radio/T.V.) (English) + (History)** √ ***Inquiry-Based Web-Based***	**CHE 131 ENG 111-112 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Lab Tops, Chemical Test Kits, DO Meter, pH/Conductivity/TDS Meters, BOD-5 Glassware, Turbidity Tubes, and a Spectrophotometer**

Week 35	**Conducting Research + Experiments (34, 35)** *Characteristics and Principles of Water (16.1.5 8,10, 11)* **Identify Wastewater Techniques (16.2.1, 2, 3, 6)** *Constituents of Water (16.4.5)* **Analyzing Water (16.5.3, 4, 6, 7) Technical Writing/Documentation (unit 50)**	**Math Measurement-B (11, 12) Math Processes-B (8 – 10) Earth and Space-C (11. 12) D (9, 10) Life Sciences- B C (11, 12) D F (9, 10) Scientific Inquiry- A (11, 12) Physical Science- C (9,10)** *Formal Presentations (3.9) Core Competencies* ←	**Biological Slideshows,** ***Outdoor Biological Sampling (macroinvertebrates, algae, and bacteria)***	**Project Based (Radio/T.V.) (English) + (History)** √ *Inquiry-Based* *Web-Based*	**ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Lab Tops, Biological Photos, Dissecting Microscopes, Collection Glassware, Tweezers, Slides, + Kick Seines**
Week 36	**Water Quality Final Exam** *(All Competencies From Water Quality Apply)*	**Water Quality Final Exam** *(All Standards From Water Quality Apply)*	**Water Quality Final Exam** ***Habitat/Biological and Chemical Parameters***	**Project Based (Radio/T.V.) (English) + (History)** √ *Inquiry-Based*	**CHE 131 ENG 111-112 BIO 111-113 COM 225 BTN 120 BTN 110 MAT 106 BIS 160**	**Presentations include Video, Powerpoint, Projector, and Audio Equipment**

- **All slideshow lectures and vocabulary are digital.**
- **Student Lab Reports are hand written and final copy submitted electronically.**
- **Online Software "Classjump" will be used as an interface module.**

Graduating Biotechnology seniors will receive college credit from Sinclair in the following classes below:

BTN 110 (Biotechnology and Bioethics) 3 credits

BTN 120 (Laboratory Safety and Regulatory Compliance) 3 credits

Biotechnology students also have the potential to test out of the following classes below:

BIS 160 (Introduction to Word, PP, Excel, Access) 3 credits

BIO 107 (Human Biology) 5 credits

Teacher: Joshua Roark

Sinclair Faculty: Angie Currier

Class: Biotechnology (12th Grade)

PCTC/Sinclair Pacing Guide

E.D. = Ellyn Daugherty Text/Lab Book

BioRad = Labs from BioLab Manual

All labs are Inquiry Based (Writing Lab Reports)

2010 – 2011

Week	Lecture + Lab Focus *(online activity, quizzes, and homework not shown)*	Key Skill Objectives	Major Equipment	Teaching Method	Career Technical Competencies Reference	Academic Curriculum Reference
1 Q1	Syllabi, *Reviewing Rules and Regulations*, Summer Update PPT, *Pre-Test,* Project-Demos, *Biotechnology Review* REVIEW 11TH GRADE TOPICS BELOW: Chemical Safety + Handling, *Biohazard Storage,* Conducting Experiments, Scientific notebook, *Scientific Method,* Knowing 10th + 11th Grade Equipment Used	Understand regulations + mission Recap of summer activities Inventory + scope of new lab equipment Work on team inquiry projects Recap of major 11th grade competencies Review master competencies on chemical safety & handling, biohazard storage, conducting experiments, scientific method, and basic equipment that was used in lecture and labs from the 10th and 11th grade	**All Biotech Equipment Exposed at the 10th/11th Grade Levels**	***Inquiry, Problem, Case, Web, Discovery and Project-Based***	**Laboratory Safety, Chemical Materials & Chemical Handling (35.0/ 36.1 – 36.6)** ***Chemical Materials Handling & Biohazard Storage (38.1 – 38.2.7 & 40.1 – 40.3.10)*** **Conducting Experiments Review (35.1 – 35.3)** **Sc. Mth./Exp. (34, 35) Exploring** **Biotechnology + Industry (unit 49)** **Bioethics (48)**	**Communications E (11,12) Writing Applications D (11,12) Reading Process B (8 - 12) Reading Process-C (8-10) Science Inquiry-A (11,12) Research-B (11,12) Math Data Analysis A (11,12), F (8-10) Math Processes-B (11,12) Government-A (11,12) Social Studies Skills A (11,12)**
2	Master Lecture + Lab Competencies Below: 3.1 (A) Pipeting/Measuring Volumes (B) Micropipeting *3.2 (C) Mass Measurement/Making Solutions* 3.3 (E) Mass (Vol. Sol.) *3.4 (F) Percent Mass (Vol. Sol.)* 3.5 (G) Molar Solutions *3.6 (H) Dilutions*	Review and Master Below: A) Demonstrate skill using plastic pipets, manual pipet pumps, digital & electronic pipeters, and seripipetors. *B + C) Demonstrate skill using micropipets* E)Prepare various mass/volume solutions *F) Prepare various percent mass/volume solutions* G) Prepare various molar solutions *H) Prepare dilutions of solutions*	**Lab Tops, Reagents, Micropipeters, Seripipeters, Pipet Pumps , Glassware, Analytical Balances, Table Top Balances, Hot Plates/Mag. Stir**	***Inquiry, Web, and Problem-Based***	**Concepts of Measurement (39.1.1 – 39.1.12)** ***Pipeting & Analytical Balance Skills (37.1.1, 2, 4)*** **Chem. Lab Skills (42.2, 3, 4)** **Chemical Calculations (38.1.8) (42.1, 2, 7, 8)** **Bioethics (48)**	**Vocabulary D (11,12)** **Vocabulary Acquisition F, E (8 - 12)** **Math- Measurement D, E (8 – 10) A, B (11 – 12)** **Math-Data/Probability D (8-10)**

3	7.1 A) Spectrophotometers *(DR2800, UV + V-Spec., Colorimeter)* *B) Using the Spectrophotometer to Study Molecules, Standard Wavelength Curves, and Beers Law Lab* C) Determination of Chlorophyll in Olive Oil Lab *D) Counting E. Coli Colonies Lab*	<u>Review and Master Below A+B:</u> A) Learn how to operate a DR2800 water spectrophotometer and TNT Tests Results *B) Learn how to operate a spectrometer/spectrophotometer and how light corresponds to colors of the visible spectrum in determining unknowns from knowns, construct standard curves, apply concepts to spectroscopic analytical methods* C) Measure and analyze the visible light absorbance spectra of different olive oils with respect to chlorophyll *D) Prepare serial dilutions of E. Coli and count cells using the Spectrophotometer*	**Spectrophotometer (DR2800), Spectrophotometers, Colorimeters, Reagents, Pipet Pumps, Glassware, Micropipeters, Bunsen Burners, and Water Baths**	***Inquiry, Web, and Problem-Based***	**Conducting Experiments Review (35.1 – 35.3)** ***Spectrophotometer + Standard Curves (37.5)*** **Spectroscopic Analytical Methods (37.7)** ***Calibrate equipment accurately (37.9)***	**Patterns, Functions + Algebra C + D, 8-10** **Physical Science G (9-10)** **Vocabulary D (11,12)** **Writing Applications D (11,12)**
4	<u>Review:</u> 2.3 Molecules of Cells *(Carbohydrates, Lipids, Proteins, Nucleic Acids)* <u>New:</u> 5.1 (A) (Structure & Function of Proteins) Antibody Function 5.2 Protein Structure (Insulin) *5.3 Protein Catalysts* *(B) Enzyme Function Lab* (C) Protease Assay Lab	<u>Review:</u> Macromolecules (structure/function) <u>New Materials Listed Below:</u> A) Simulate antibody-antigen testing *B) Test enzyme activity at different concentrations* C) Experimental design * *Protein Chemist Career Exploration*	**Petri-Dishes, Reagents, Table Top Balances, Pipet Pumps, Glassware, Micropipeters,**	***Inquiry Discovery, Web, and Problem-Based***	**Molecular Behavior of Amino Acids + Peptides (42.7)** **Explain Protein Properties (42.8)** **Physical/Chemical Properties of Proteins (45.7)** **Perform Enzyme Assays (42.9)** **Conducting Experiments (35.1 – 3)** **Prepare Lab Reagents (42.1)** **Bioethics (48)**	**Physical Science B, C (9,10) A (11,12)** **Vocabulary D, E (11,12)** **Number Operations G (8-10)** **Writing Applications D (11,12)**

5	5 (D) Protein Indicator Analysis Lab 7.2 Adjusting Buffer pH Review 7.3 (D) Making Buffers Review *5 (E) Analysis of Protein by Vertical Gel Electrophoresis Lab*	5 D) Prepare a serial dilution of protein solution to differentiate between concentrations (biuret reagent) 7 (D) Prepare a buffer to use in making a protein solution *5 E) Prepare a polyacrylamide gel electrophoresis (PAGE) running buffer and use it to prepare protein samples for gel analysis*	**Reagents, Tabletop Balances, Micropipeters, Spectrophotometers, Glassware, Analytical Balances, Plastic Syringes, Pipet Pumps, pH meters**	***Inquiry Discovery, Web, and Problem-Based***	**Perform Lab Reagents (42.1)** **Conducting Experiments (35.1 – 3)** **45.8.4 Protein Buffer** **Perform Electrophoresis of Protein Samples (45.10)** **Prepare Lab Reagents (42.1)**	**Vocabulary D, E (11,12)** **Number Operations G (8-10)** **Physical Science B, C (9,10)** **Writing Applications D (11,12)**
6	5.4 (F) Studying Proteins Lab (PAGE Gel)	Prepare protein samples and load, run, stain and characterize proteins on a PAGE gel *(amylase, pectinase, cellulase, and lysozyme)*	**Reagents, Tabletop Balances, Micropipeters, Spectrophotometers, Glassware, Analytical Balances, Plastic Syringes, Pipet Pumps, Microcentrifuges, Dry Block Heaters, Vertical Gel Boxes, Lab Rotators, Imaging Light Systems,**	***Inquiry Discovery, Web, and Problem-Based***	**Perform Electrophoresis of Protein Samples (45.10)** **Prepare Lab Reagents (42.1)** **Conducting Experiments (35.1 – 3)**	**Vocabulary D, E (11,12)** **Number Operations G (8-10)** **Physical Science B, C (9,10)** **Writing Applications D (11,12)**
7	5.5 (G) Applications of Protein Analysis Lab (Identifying Proteins)	Prepare animal muscle tissue samples to run gels to study differences in protein composition/structure, apply protein electrophoresis, explore evolution, and construct cladograms *Biorad's Protein Profiler Kit + Daugherty's Inquiry Lab* ** Pharmaceuticals Clinical Research Career Exploration*	**Reagents, Tabletop Balances, Micropipeters, Spectrophotometers, Glassware, Analytical Balances, Plastic Syringes, Pipet Pumps, Microcentrifuges, Dry Block Heaters, Vertical Gel Boxes, Lab Rotators, Imaging Light Systems, Mortars/Pestles**	***Inquiry Discovery, Web, and Problem-Based***	**Physical/Chemical Properties of Proteins (45.7)** **Perform Electrophoresis of Protein Samples (45.10)** **Conducting Experiments (35.1 – 3)** **Perform Sample Analysis (42.6)** **Prepare Lab Reagents (42.1)**	**Vocabulary D, E (11,12)** **Number Operations G (8-10)** **Physical Science B, C (9,10)** **Writing Applications D (11,12)**

8	6.1 Sources of Potential Products (Assay Development) B) Starch and Sugar Assays Lab 6.2 The Use of Assays C) Amylase Assay Lab *6.3 Products From Nature* *D) Plant Substances Lab*	*A) Team Project- Prepare an Assay* *B) Conduct aldose and starch indicator tests* C) Test saliva for alpha-amylase activity *PART 1:* *D) Extract compounds from plants and test the extracts' antimicrobial activity on the growth of E. Coli.*	**Reagents, Tabletop Balances, Micropipeters, Spectrophotometers, Glassware, Plastic Syringes, Pipet Pumps, Dry Block Heaters, Vertical Gel Boxes, Lab Rotators, Vortexers, Autoclave, Water Baths, Bunsen Burners, Petri Dishes Incubator**	***Inquiry Discovery, Web, and Problem-Based***	**Perform Enzyme Assays (42.9)** **Prepare Lab Reagents (42.1)** **Conducting Experiments (35.1 – 3)** **Biochemical assays of carbohydrates "Activity Assays" (42.13)** **Biochemical assays of lipids "Concentration Assays" (42.14)** **Perform Sample Analysis (42.6)**	**Life Sciences A (11,12)** **Physical Science A (11,12)** **Writing Applications D (11,12)** **Vocabulary D, E (11,12)**
9 **Q2**	*6.4 Plant Proteins as Products (Labs: D – H)* *D) Plant Substances* *F) Hydrogen Peroxidase Assay* *G) HRP Isolation-PAGE gel* *H) HRP Activity Using TMB* 6.5 Producing Recombinant DNA Protein Products E) Searching for Native Amylase Lab	*PART 2:* *D) Extract compounds from plants and test the extracts' antimicrobial activity on the growth of E. Coli.* *F) Testing plant/animal samples for oxygen gas (add H_2O_2)* *G) Isolation of HRP (plant enzyme) from Horseradish root on a PAGE Gel* *H) Isolate HRP enzyme and use TMB as a colorimetric assay for peroxidase activity (freeze samples for ELISA)* E) Predict where amylase-producing bacteria might be found in nature and attempt to isolate colonies	**Reagents, Tabletop Balances, Micropipeters, Spectrophotometers, Glassware, Plastic Syringes, Pipet Pumps, Dry Block Heaters, Vertical Gel Boxes, Lab Rotators, Vortexers, Autoclave, Water Baths, Bunsen Burners, Petri Dishes Incubator, Hotplates, Imaging Light Systems**	***Inquiry Discovery, Web, and Problem-Based***	**Microbiology (41.1-3)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Perform Enzyme Assay (42.9)** **Bioethics (48)**	**Vocabulary D, E (11,12)** **Life Science A (9-12)** **Physical Science A (11,12)** **Writing Applications D (11,12)**

10	7.4 Determining Protein Concentration *F) Amylase Analysis Using Spectrophotometers Lab* G) Determining Amylase Concentration Lab I) UV Spec to Study Proteins Lab	*F) Determine the absorbance spectrum for amylase-Bradford reagent to learn Lambda max* G) Use a best fit standard curve to determine the concentrations of unknown amylase solutions I) Use a VIS-Spec to determine the Lambda max for a sample of colorless proteins	**Micropipets, Pipet Pumps, Reagents, Spectrophotometers, Glassware**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Biochemical assays of lipids "Concentration Assays" (42.14)** ***Spectrophotometer + Standard Curves (37.5)*** ***Calibrate Equipment Accurately (37.9)*** **Bioethics (48)**	**Life Science A (9-12)** **Physical Science A (11,12)** **Writing Applications D (11,12)** **Vocabulary D, E (11,12)**
11	<u>Review Chapter 4.4</u> *Agarose Gel Electrophoresis* <u>Recombinant Biotechnology</u> 8.1 Overview of Genetic Engineering A) Restriction Digestion of Lambda Phage Lab B) Restriction Digestion Used to Verify pAmylase Plasmid Lab	A) Conduct a restriction digest of the Lambda DNA to learn about restriction enzymes, and conduct a restriction digestion of the pAmylase to confirm prior to transformation of E. Coli cells B) Conduct a restriction digestion of pAmylase plasmid with HindIII and BamHI to confirm desired plasmid prior to transformation of E. Coli cells (Learn about different restriction enzymes)	**Water Baths, Micropipeters, Reagents, Gel Drying System, Microcentrifuges, Ice Buckets, Horizontal Gel Boxes, Power Supplies**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Apply Concepts of DNA Technology (43.3)** **Isolate/Characterize DNA (43.4)** **Relate Molecular Biology to Humans (43.7)**	**Life Science A, C (11,12), J (9,10)** **Physical Science A, B (9,10)** **Science Technology B (9,10)** **Vocabulary D, E (11,12)** **Writing Applications D (11,12)**
12	<u>Recombinant Biotechnology</u> 8.2 Bacterial Transformation C) Transformation of E. Coli with pAmylase Lab * <u>Start culture of cells at end of week 13 for Lab D on week 14</u>	Prepare reagents and media for the transformation lab Transfer plasmids into E. Coli and select transformants	**Water Baths, Micropipeters, Reagents, Glassware, Fumehood, Ice Buckets, Bunsen Burners, Incubator, Pipet Pumps**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Historical Developments in Modern DNA Technology (43.2)** **Conducting Experiments (35.1 – 3)**	**Life Science A (11,12)** **Vocabulary D, E (11,12)** **Writing Applications D (11,12)**

13	<u>Recombinant Biotechnology</u> 8.2 Bacterial Transformation *Transform bacteria with jellyfish gene, turn the modified genes on or off, and study gene regulation* * Transformation of E. Coli with pGlO Lab	Prepare reagents and media for the transformation lab Transfer plasmids into E. Coli and select transformants *Biorad's PGLO Kit* ** Biochemist/Molecular Biologist Research Career Exploration*	**Water Baths, Micropipeters, Reagents, Glassware, Fumehood, Ice Buckets, Bunsen Burners, Incubator, Pipet Pumps**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Historical Developments in Modern DNA Technology (43.2)** **Conducting Experiments (35.1 – 3)**	**Life Science A (11,12)** **Vocabulary D, E (11,12)** **Writing Applications D (11,12)**
14	<u>Recombinant Biotechnology</u> 8.3 Scaling Up Cell Cultures D) Growing and Monitoring Bacterial Cultures Lab E) Scaling up E. Coli Culture for Amylase Production	D) Start, maintain, and monitor E. Coli broth cultures E) Select colonies and scale them up from a selection plate to selection broth media	**Tabletop Balances, Glassware, Reagents, Hot Plate/Mag. Stir, Autoclave, Fumehood, Bunsen Burners, Incubator, Water Baths, Pipeters, Pipet Pumps, Spectrophotometers**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Cell Culturing (44.1 – 7)** **Bioethics (48)**	**Life Science A,G (11,12** **Vocabulary D, E (11,12)** **Writing Applications D (11,12)**
15	9.1 Harvesting a Protein Product A) Harvesting Amylase Lab	Separate transformed cells from broth and test the broth for amylase activity <u>*"Use cultured cells from lab 8E or grow new culture and use Activity Assay to conduct Amylase activity"*</u>	**Water Baths, Pipet Pumps, Reagents, Bunsen Burners, Fumehood, Incubator, Glassware, Centrifuges**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Cell Culturing (44.1 – 7)** **Biochemical assays of carbohydrates "Activity Assays" (42.13)** **Basic Chromatographic Theory (45.1)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Life Sciences A (11,12)** **Physical Science A (11,12), C (9,10)**
16	9.2 Using Chromatography to Study and Separate Molecules Dialysis of Protein Buffers Lab	Use dialysis tubing to conduct a buffer exchange prior to column chromatography	**Pipet Pumps, Reagents, Glassware, Centrifuges, Micropipets, Dry Block Heaters**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)**
17 **Q3**	Size Exclusion Chromatography Lab (hemoglobin/vitamin B12 mixture using P-60 columns	Separate a mixture of biomolecules, determine the number of components in a mixture, study the chemical and physical properties of biomolecules, apply the principles of chromatography *Biorad's Size Exclusion Chromatography Lab Kit*	**Transfer Pipets, P-60 Columns, Reagents, Chromatography Poly-Prep Columns, Spectrophotometers**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Perform Ion Exchange Chromatography (45.9)** **Interpret Chromatographic Results (45.2)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Scientific Inquiry A (9-12)**

18	9.3 Column Chromatography C) Using Ion-Exchange Chromatography Lab	Separate lysozyme from albumin on an ion-exchange column ** Protein Manufacturing Research Career Exploration*	**Reagents, Glassware, Micropipets, Spectrophotometers, Chromatography Columns**	***Inquiry Discovery, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Protein Bioseparation Methods (42.1 – 4)** **Perform Ion Exchange Chromatography (45.9)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Research B (8-12)**
19	9.4 Product Quality Control + 9.5 Marketing and Sales D) Ion-Exchange Purification of Amylase	Use an ion-exchange column to determine the overall charge of amylase at pH 7.2 and isolate amylase from a broth culture	**Micropipets, Reagents, Pipet Pumps, Chromatography Columns, Spectrophotometers**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Perform Ion Exchange Chromatography (45.9)** **Bioethics (48)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Research B (8-12)**
20	Biotech Capstone Research Project Part 1- Preparing for Local Science Fair	Students work on independent research as an inquiry project to present at Science Fair and to industry leaders during the senior capstone festival.	**Any to all Biotech Equipment**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Writing/Documentation (50)**	**Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Research B (8-12)**
21	Biotech Capstone Research Project Part 2- Preparing for Local Science Fair	Students work on independent research as an inquiry project to present at Science Fair and to industry leaders during the senior capstone festival.	**Any to all Biotech Equipment**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Writing/Documentation (50)**	**Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Research B (8-12)**
22	Biotech Capstone Research Project Part 3- Preparing for Local Science Fair	Students work on independent research as an inquiry project to present at Science Fair and to industry leaders during the senior capstone festival.	**Any to all Biotech Equipment**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Writing/Documentation (50)**	**Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Research B (8-12)**

23	Biotech Capstone Research Project Part 4- *Local Science Fair Competition!*	Students work on independent research as an inquiry project to present at Science Fair and to industry leaders during the senior capstone festival. *Students present their research at the Local Science Fair*	**Any to all Biotech Equipment**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Writing/Documentation (50)**	**Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Research B (8-12)**
24	13.1 Making DNA Molecules *(in vivo and in vitro replication)* A) DNA Synthesis Lab B) Separating DNA Fragments on a PAGE Gel Lab	A) Replicate a DNA strand from a template, use Southern Blot, Colormetric Visualization *Can DNA fragments at different lengths be synthesized in vitro? How does changing dNTP's affect DNA synthesis strand development?* B) Prepare and load a DNA PAGE gel and separate DNA molecules on a gel for future study	**Reagents, Glassware, Micropipets, Water Baths, Microcentrifuges, Dry Block Heaters, Vertical Gel Boxes, Power Supplies**	***Inquiry Discovery, Web, and Problem-Based***	**Isolate DNA (43.4)** **Advanced DNA Techniques (43.6)** **Applications of Molecular Biology (43.7)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)**	**Vocabulary D, E (11,12)** **Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Life Sciences A (11,12)**
25	13.2 DNA Synthesis Products (Southern Blotting and Primers) C) Conducting a Southern Blot Lab *D) Visualizing DNA on a Southern Blot Lab*	C) Transfer DNA synthesis fragments from Lab A/B to a positively charge nylon membrane for staining and visualizing the fragment lengths *D) Use a colormetric method to visualize the DNA synthesis fragments on a Southern Blot membrane (or use Biorad methods to visualize blots)*	**Reagents, Glassware, Micropipets**	***Inquiry Discovery, Web, and Problem-Based***	**Advanced DNA Techniques (43.6)** **Applications of Molecular Biology (43.7)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)**	**Vocabulary D, E (11,12)** **Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Life Sciences A (11,12)**
26	Biotech Capstone Research Project Part 5- Preparing for District Science Fair (Central State University) *Research Presentation on Weekend!*	Students work on independent research as an inquiry project to present at Science Fair and to industry leaders during the senior capstone festival. *Students present their research at the District Science Fair- Central State*	**Any to all Biotech Equipment**	***Inquiry and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Writing/Documentation (50)** **Other Biotech Standards that may apply (35 – 49)**	**Scientific Inquiry- A (11, 12)** **Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)**

27	13.3 Polymerase Chain Reaction (Primers, Taq Polymerase) E) Using PCR to Amplify Regions of Lambda Phage DNA Lab *F) Extracting DNA from Human Cells for PCR and Sequencing Lab*	E) How many regions of Lambda DNA are amplified using the Pf primer and Pr primer? What are the sizes of the PCR products? *F) Collect cheek or hair cell samples, isolate DNA from cells*	**Thermocyclers, Reagents, Glassware, Micropipets, Horizontal Gel Boxes, Power Supplies, Air Gel Dryer, Tabletop Balances, Microcentrifuges, Dry Block Heaters, Vortexers, Rocking Platforms**	***Inquiry Discovery, Web, and Problem-Based***	**Isolate DNA (43.4)** **Advanced DNA Techniques (43.6)** **Applications of Molecular Biology (43.7)** **Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)** **Life Sciences A (11,12)**
28 **Q4**	13.3 Polymerase Chain Reaction (Primers, Taq Polymerase) G) PV92 Informatics Lab	G) Use DNA samples from lab F for PCR amplification, analyze student allelic frequencies, compare classroom genetic composition with other populations around the world *(determine Hardy-Weinberg analysis on results; web-based bioinformatics)* *Biorad's PV92 Informatics Lab Kit*	**Thermocyclers, Reagents, Glassware, Horizontal Gel Boxes, Power Supplies, Microcentrifuges, Micropipets, Gel Air Dryer, Water Baths, Vortexers, Rocking Platforms**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Applications of Molecular Biology (43.7)** **Genetics and Heredity (43.1)** **Advanced DNA Techniques (43.6)** **Bioethics (48)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)** **Life Sciences A (11,12)**
29	14.1 Advanced Protein Studies *Bioethics, Sanger Method* 14.2 + 14.3 Advanced DNA + Protein Studies *HIV, Mad Cow, SARS, West Nile, Biodefense, Cancer Treatment, Drug/Steroid Testing, Pregnancy, Reproduction, GMO's* A) ELISA Immuno Explorer Lab	*Apply genuine diagnostic procedures, simulate real-world HIV testing, simulate GMO, pregnancy, and drug testing* *Biorad's ILISA Immuno Explore Lab Kit* ** Forensics, Genetics, Advanced Molecular Biologist Research Career Exploration*	**Micropipeters, Reagents, Glassware, Micropipete Readers**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Antibody Meditated Immunity (44.8)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)** **Life Sciences A (11,12)**

30	14.3 Advanced Protein Studies B) Using a Western Blot to Identify Actin Lab	B) Conduct a Western Blot to identify actin in solution	**Vertical Gel Boxes, Micropipets, Reagents, Glassware, Dry Block Heaters, Microcentrifuges**	***Inquiry Discovery, Web, and Problem-Based***	**Prepare Lab Reagents (42.1)** **Perform Sample Analysis (42.6)** **Conducting Experiments (35.1 – 3)** **Antibody Meditated Immunity (44.8)** **Bioethics (48)**	**Vocabulary D, E (11,12)** **Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)** **Life Sciences A (11,12)**
31	Review Lecture + Labs for State Core Exam *Senior Capstone Research and Documentation Part A*	Seniors Review Biotech Lecture and Labs in Preparing for State Core Exam *Seniors work on Biotech Research for Capstone Project*	**Any to all Biotech Equipment and Reagents**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Technical Writing/Documentation (unit 50)** **Formal Presentations (3.9)** **Core Competencies (1-5)**	**Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)**
32	<u>State Core Exam</u> *Senior Capstone Research and Documentation Part B*	Seniors take State Core Examination *Final Week to Finish Biotech Research for Capstone Project*	**Any to all Biotech Equipment and Reagents**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Technical Writing/Documentation (unit 50)** **Formal Presentations (3.9)** **Core Competencies (1-5)**	**Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)**
33	Senior Capstone Final Week (Trial Run) & <u>*Final Presentation With Industry Partners*</u>	Seniors Finalize Biotech Research and Practice Presenting Powerpoint/Video <u>*Seniors Present Project to Industry Partners*</u>	**Any to all Biotech Equipment and Reagents**	**Inquiry, Project *and Problem-Based***	**Conducting Research + Experiments (34, 35)** **Technical Writing/Documentation (unit 50)** **Formal Presentations (3.9)** **Core Competencies (1-5)**	**Writing Applications D (11,12)** **Scientific Inquiry- A (11, 12)**
34	<u>Final Exam</u> Lab Cleanup + Inventory Last week of Senior Students	<u>Final Exam Grade:</u> 50% from the State Core Exam Score and 50% from the Senior Capstone Project Presentation Score ** Lab gets thoroughly cleaned!*	**Chemical Reagents**	**Inquiry, Project *and Problem-Based***	**Laboratory Safety, Chemical Materials & Chemical Handling (35.0/ 36.1 – 36.6) Chemical Materials Handling & Biohazard Storage (38.1 – 38.2.7 & 40.1 – 40.3.10)**	**Science Inquiry- A (9, 10)**
35	NO SENIORS	X	**X**	**X**	**X**	**X**
36	NO SENIORS	X	**X**	**X**	**X**	**X**

- **All slideshow lectures and vocabulary are digital.**
- **Student Lab Reports are hand written and final copy submitted electronically.**
- **Online Software "Classjump" will be used as an interface module.**

All Biotechnology content references the following Sinclair Community College classes:

ENG 111-112
COM 225
BTN 120
BTN 110
MAT 106
BIS 160

*** CHEM 131 is included in many lectures and labs.**

Graduating Biotechnology seniors will receive college credit from Sinclair in the following classes below:

Articulate Classes:

BTN 110 (Biotechnology and Bioethics) 3 credits

BTN 120 (Laboratory Safety and Regulatory Compliance) 3 credits

Biotechnology students also have the potential to test out of the following classes below:

BIS 160 (Introduction to Word, PP, Excel, Access) 3 credits

BIO 107 (Human Biology) 5 credits