STEM Pathways and Programs of Study in the Land of Lincoln

A High School Companion to the *Illinois Programs of Study Guide*

Joel R. Malin

Office of Community College Research and Leadership
Department of Education Policy, Organization and Leadership
College of Education
University of Illinois at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

Pathways Resource Center

ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Suggested Citation:

Malin, J. R. (2014). *STEM pathways and programs of study in the Land of Lincoln: A high school companion to the Illinois Programs of Study Guide.* Champaign, IL: Office of Community College Research and Leadership, University of Illinois at Urbana-Champaign.

Table of Contents

Introduction

In 2009, the Office of Community College Research and Leadership (OCCRL) at the University of Illinois at Urbana-Champaign developed the *Illinois Programs of Study Guide* (Taylor, Kirby, Bragg, Oertle, Jankowski, & Khan, 2009). It is comprehensive in nature and is meant to assist developers, implementers, and evaluators of programs of study (POS). The guide includes important background information and describes a set of useful guiding principles and design elements to assist with POS implementation. These guiding principles and design elements were vetted by a statewide group of secondary and postsecondary practitioners and were intentionally designed to provide direction rather than prescription. This decision reflected the group's recognition that constraints and opportunities vary by local context.

This supplemental document ("supplement") is meant to be complementary to the *Illinois Programs of Study Guide* (2009), with an emphasis on assisting *secondary school and district administrators and faculty* who are engaging in this work. It is written to support not only those educators who are in the early stages of program of study development and implementation but also those wishing to refine existing programs of study. Relative to the 2009 guide, this supplement is more concise; thus, the reader is referred to that guide for more in-depth information. This supplement also utilizes and aligns with the Office of Vocational and Adult Education (OVAE[1]) design framework (2010) and incorporates program of study development and implementation insights from two guides developed in other states (Arizona Department of Education, 2011; Wisconsin Department of Public Instruction, 2011; hereafter called "Arizona" and "Wisconsin," respectively). It also incorporates findings from several studies, with a special emphasis upon lessons learned from "mature" or "highly implemented" program of study sites (Alfeld & Bhattacharya, 2012; Stipanovic, Shumer, & Stringfield, 2012). Because this supplement relies heavily on Stipanovic, Shumer, et al. (2012), a summary of key findings from this study is provided in Appendix A.

This supplement was prepared as part of a contract with the Illinois State Board of Education and is funded through the federal Race to the Top grant. The topmost priority of the Pathways Resource Center (PRC) is to assist Illinois Race to the Top school districts in their selection, development, and implementation of science, technology, engineering, and mathematics (STEM) programs of study. Therefore, our target audience for this companion includes school and district leaders, faculty, and partners at these districts who are currently engaging in this important work. In this document, we attend specifically to aspects of Illinois context that are pertinent to these endeavors and focus upon STEM programs of study. Still, much of what is described likely will be useful to a broad audience. For instance, educators in other Illinois school districts are encouraged to access this information to assist their work, within STEM or other areas. More broadly, educators in other states may find this work to be valuable, with the understanding that certain aspects of the Illinois approach may differ from what is found in other states.

[1]Effective February 7, 2014, the Office of Vocational and Adult Education (OVAE) has been changed to the Office of Career, Technical, and Adult Education (OCTAE).

Purpose and Goals

The **purpose** of this supplement is as follows:

This supplement is designed to share the *Illinois Programs of Study Guide's (2009)* guiding principles and design elements. It is aimed to assist school/district leaders, faculty, and partners who wish to develop and implement a program of study. As such, it incorporates recent findings and includes introductions to a variety of resources that may be beneficial.

The **goals** of this supplement are to:
- provide a user-friendly guide to program of study development and implementation,
- provide a detailed process and suggested set of steps that can be followed,
- refer users to helpful resources relating to the topics covered, and
- assist teachers and administrators as they develop and/or improve programs of study.

Organization of Material

In this supplement, we rely heavily upon the guiding principles and design elements that are detailed in the *Illinois Programs of Study Guide* (2009). First, though, we briefly review pertinent state and federal policy information and orient the reader to the Office of Vocational and Adult Education's design framework (OVAE, 2010). We draw interconnections between these resource materials where appropriate. Next, we review the rationale for developing and implementing high quality STEM programs of study. With this groundwork in place, we provide a macro-level view of the six guiding principles and describe the manner in which they are structured and presented.

Next, we provide detailed descriptions of each guiding principle and a listing of the underlying design elements. For each guiding principle, we include a subsection that highlights connections to the OVAE design framework (2010) and/or to recent research and evaluation findings surrounding program of study development and implementation, and a fictional vignette designed to illustrate each principle "in action." Following each vignette, we include a small set of *questions for consideration*; these questions are designed to elicit critical thought about certain key actions and steps that were taken, and to challenge the reader to foresee emerging needs and next steps.

Subsequently, we provide an overview of suggested program of study development/implementation phases and steps, drawing from the Wisconsin and Arizona guides. While recognizing that program of study development and implementation will not likely unfold in an entirely predictable manner, we anticipate that these ordered sets of steps/phases will nonetheless benefit to those who are, or will be, engaging in this work.

Programs of Study, in State and National Perspective

The *Illinois Programs of Study Guide* (2009) contains an abundance of information about the broader state and federal policy context in which programs of study have been situated. At the federal level, programs of study emerged with the passage of The Carl D. Perkins Career and Technical Education Improvement Act of 2006 ("Perkins IV"); secondary and postsecondary institutions receiving Perkins funding must implement at least one program of study including certain required components. Specifically, these programs must include secondary (e.g., high school) and postsecondary (e.g., community and/or four-year college) elements, academic and technical content and course offerings in a coordinated and non-duplicative manner, must lead to an industry-recognized credential and/or postsecondary certificate or degree, and can include opportunities for students to dually enroll (Lewis, Kosine, & Overman, 2008). Ideally, these programs are responsive to local and broader labor needs/projections, include meaningful partnerships with business/industry, and employ various mechanisms to permit students' smooth transitioning across educational levels and to college and career (Taylor et al., 2009). In essence, they are intended to create coherent educational and career pathways for students, especially in view of assisting the "more than two-thirds of America's young people who (might not otherwise be) likely to graduate from a 4-year college" (Stipanovic, Lewis, & Stringfield, 2012, p. 80).

More recently, federal competitive RttT funding was awarded to Illinois school districts that pledged to engage in a set of activities and reforms, which included the development and/or refinement of at least two STEM programs of study. These Illinois districts are fortunate in several respects. Perhaps most importantly, they benefit from a well-developed, customized Illinois Career Cluster Model and a related set of guiding principles and design elements, which are presented in the *Illinois Programs of Study Guide* (2009). In this document, we aim to advance somewhat by synthesizing this information and tailoring it to high school educators and their partners, and by refreshing it with new implementation-related information and research/evaluation findings. First, let us review the Illinois career cluster model and important associated terms.

Illinois adopted the National Career Clusters® Framework (http://www.careertech.org), which offers 16 career clusters, 79 career pathways, and numerous programs of study. Below, we include definitions of terms and additional information contained in the *Illinois Programs of Study Guide* (2009).

What are Career Clusters, Career Pathways, and Programs of Study?

Career clusters are groups of occupations and industries that have in common a set of foundational knowledge and skills. There are 16 nationally recognized clusters, within which are multiple career pathways.

Cluster level knowledge and skills are built on a common core required for career success in the multiple occupations included in the cluster. This shared core consists of the following elements: academic foundations; communications; problem solving and critical thinking; information technology applications; systems; safety, health and environmental; leadership and teamwork; ethics and legal responsibilities; employability and career development; and technical skills.

Career pathways are multi-year programs of academic and technical study that prepare students for a full range of postsecondary options within each of the 16 clusters. Currently, there are 79 nationally recognized pathways, each with specific pathway knowledge and skills. These pathways provide a context for exploring career options at all levels of education and a framework for linking learning to the skills and knowledge needed for future education and employment.

Pathway level knowledge and skills are built on a common core of knowledge and skills required for career success in all programs of study aligned with the pathway. This core is specific to the pathway and consists of elements selected by secondary and postsecondary educators with input from business and industry and other stakeholders.

Programs of study (POS) are sequences of courses that incorporate a non-duplicative progression of secondary and postsecondary elements which include both academic and career and technical education content. Programs of study should start no later than the ninth grade and continue through at least two years of postsecondary education. Programs of study include opportunities to earn college credit (dual credit) in high school, an industry-recognized credential or certificate at the secondary/postsecondary level, and an associate or baccalaureate degree.

Why a Career Clusters Framework?

The framework of career pathways, career clusters, and programs of study organizes educational preparation and occupational choices into a unified concept. (See figure 1, p. 6.). By combining rigorous academics with career and technical education (CTE), students have a clear path to their future. Career clusters:

- are for all students;
- create distinct educational plans of study students can follow from secondary to postsecondary education and/or to the workplace or military;
- help create smooth transitions in the educational pipeline and reduce duplication;
- empower students through information and experiences they need to make informed educational choices;
- help counselors, teachers, parents, and students design individual plans of study; and
- comprise a key element in enhancing economic development by connecting educational institutions with business and industry.

Table 1: The 16 Career Clusters™

Agriculture, Food & Natural Resources
The production, processing, marketing, distribution, financing, and development of agricultural commodities and resources including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

Architecture & Construction
Careers in designing, planning, managing, building and maintaining the built environment.

Arts, A/V Technology & Communications
Designing, producing, exhibiting, performing, writing, and publishing multimedia content including visual and performing arts and design, journalism, and entertainment services.

Business Management & Administration
Careers in planning, organizing, directing and evaluating business functions essential to efficient and productive business operations.

Education & Training
Planning, managing and providing education and training services, and related learning support services such as administration, teaching/training, administrative support, and professional support services.

Finance
Planning and related services for financial and investment planning, banking, insurance, and business financial management.

Government & Public Administration
Planning and executing government functions at the local, state and federal levels, including governance, national security, foreign service, planning, revenue and taxation, and regulations.

Health Science
Planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

Hospitality & Tourism
Preparing individuals for employment in career pathways that relate to families and human needs such as restaurant and food/beverage services, lodging, travel and tourism, recreation, amusement and attractions.

Human Services
Preparing individuals for employment in career pathways that relate to families and human needs such as counseling and mental health services, family and community services, personal care, and consumer services.

Information Technology
Building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support and management of hardware, software, multimedia and systems integration services.

Law, Public Safety, Corrections & Security
Planning, managing, and providing legal, public safety, protective services and homeland security, including professional and technical support services.

Manufacturing
Planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering.

Marketing
Planning, managing, and performing marketing activities to reach organizational objectives such as brand management, professional sales, merchandising, marketing communications and market research.

Science, Technology, Engineering & Mathematics
Planning, managing, and providing scientific research and professional and technical services (e.g., physical science, social science, engineering) including laboratory and testing services, and research and development services.

Transportation, Distribution & Logistics
The planning, management, and movement of people, materials, and goods by road, pipeline, air, rail and water and related professional and technical support services such as transportation infrastructure planning and management, logistics services, mobile equipment and facility maintenance.

Source: National Association of State Directors of Career Technical Education Consortium. (2012). *The 16 career clusters®*. Retrieved from http://www.careertech.org/career-clusters/glance/careerclusters.html

Note: Information on Illinois's Career Cluster model is available on the Illinois Community College Board website at

http://iccbdbsrv.iccb.org/programsofstudy/clusters.html

Figure 1: Career Cluster Framework

Government & Public Administration
Governance
National Security
Foreign Service
Planning
Revenue & Taxation
Regulation
Public Management & Administration

Marketing
Marketing Management
Professional Sales
Merchandising
Marketing Communications
Marketing Research

Business Management & Administration
General Management
Business Information Management
Human Resources Management
Operations Management
Administrative Support

Information Technology
Network Systems
Information Support & Services
Web & Digital Communications
Programming & Software Development

Finance
Securities & Investments
Banking Services
Business Finance
Accounting
Insurance

Law, Public Safety, Corrections & Security
Correction Services
Emergency & Fire Management Services
Security & Protective Services
Law Enforcement Services
Legal Services

Manufacturing
Production
Manufacturing Production Process Development
Maintenance, Installation & Repair
Quality Assurance
Logistics & Inventory Control
Health, Safety & Environmental Assurance

Transportation, Distribution & Logistics
Transportation Operations
Logistics Planning & Management Services
Warehousing & Distribution Center Operations
Facility & Mobile Equipment Maintenance
Transportation Systems/Infrastructure Planning, Management & Regulation
Health, Safety & Environmental Management
Sales & Service

Architecture & Construction
Design/Pre-Construction
Construction
Maintenance/Operations

Arts, Audio/Video Technology & Communications
Audio and Video Technology & Film
Printing Technology
Journalism & Broadcasting
Telecommunications
Performing Arts
Visual Arts

Science, Technology, Engineering & Mathematics
Engineering & Technology
Science & Math

Human Services
Early Childhood Development & Services
Counseling & Mental Health Services
Family & Community Services
Personal Care Services
Consumer Services

Hospitality & Tourism
Restaurants & Food/ Beverage Services
Lodging
Travel & Tourism
Recreation, Amusements & Attractions

Education & Training
Administration & Administrative Support
Professional Support Services
Teaching/Training

Health Science
Diagnostic Services
Support Services
Health Informatics
Therapeutic Services
Biotechnology Research & Development

Agriculture, Food & Natural Resources
Food Products & Processing Systems
Plant Systems
Animal Systems
Power, Structural & Technical Systems
Natural Resources Systems
Environmental Service Systems
Agribusiness Systems

Business, Marketing and Computer Education
Technology and Engineering Education
Family and Consumer Sciences
Health Sciences Technology
Agricultural Education

1 Essential Knowledge and Skills
2
3
4

Career Cluster Framework
1 Essential Knowledge and Skills
2 CTE Areas: Secondary (5)
3 Career Clusters (16)
4 Career Pathways (79)

June 8, 2009
http://www.careerclusters.org

Programs of Study, in State and National Perspective (continued)

How Do Career Clusters Flow Into Career Pathways and Programs of Study?

Figure 2 provides an example of the relationship between an Illinois CTE area and its associated career cluster, as well as the pathways that fall within it. Moreover, sample programs of study are provided. In this case, Health Sciences Technology is illustrated, including its five career pathways. The programs of study within these pathways are too numerous to include, but some examples are provided.

Figure 2. Illinois' Career Cluster Model
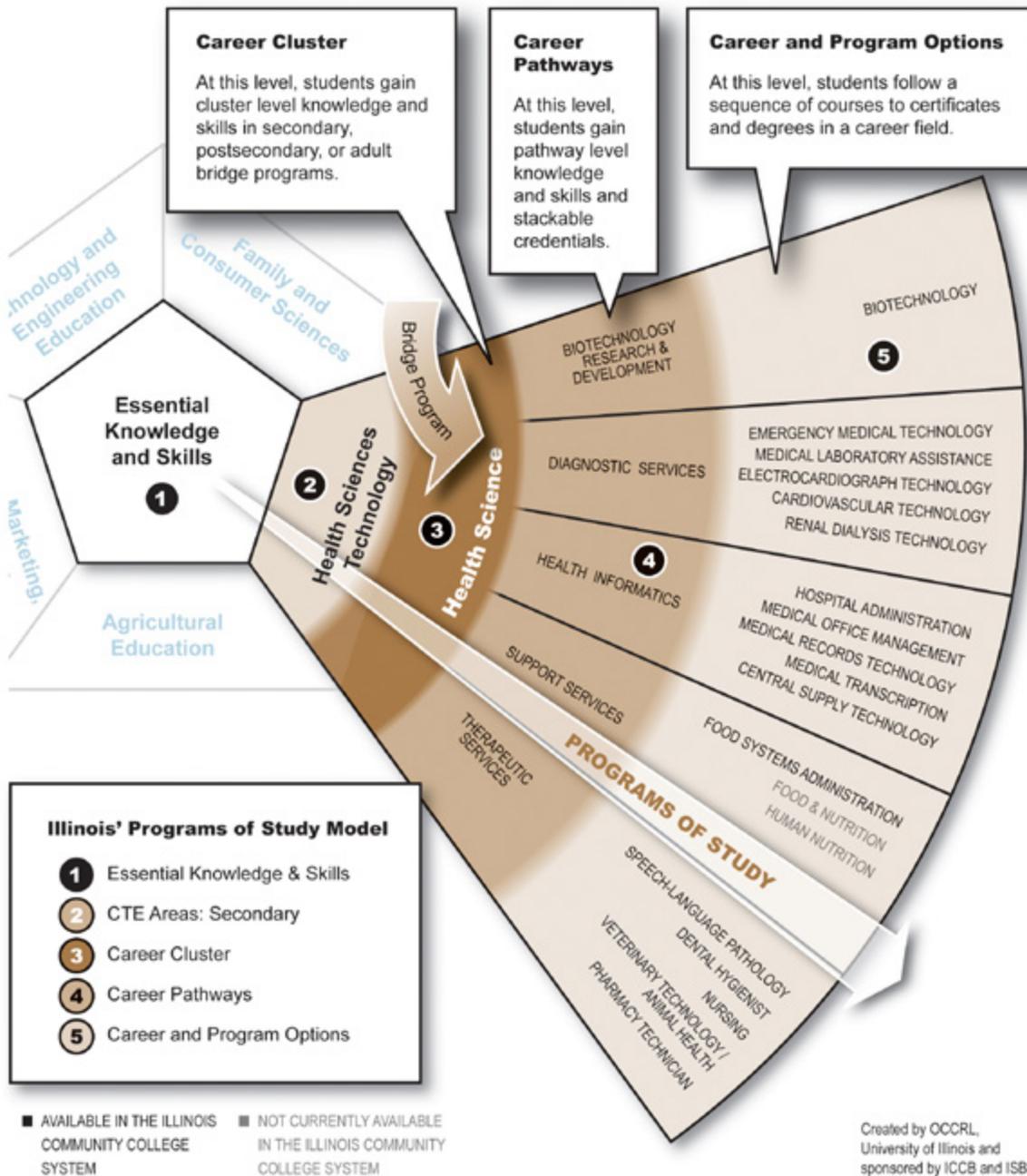
Programs of Study, in State and National Perspective (continued)

More recently, OVAE (2010) further expanded on basic POS requirements by releasing a design framework for high quality POS. This framework, and recent research and evaluation findings, reflect a distinction between programs of study that meet basic requirements, and programs that are dynamic, rigorous, and truly responsive to students' and broader societal needs. The reader is encouraged to review this framework in its entirety: http://cte.ed.gov/nationalinitiatives/POS_Framework_Components_and_Subcomponents2-24-10.doc. The framework includes a set of 10 components, which are depicted in Figure 3.

Figure 3. Program of Study Design Framework
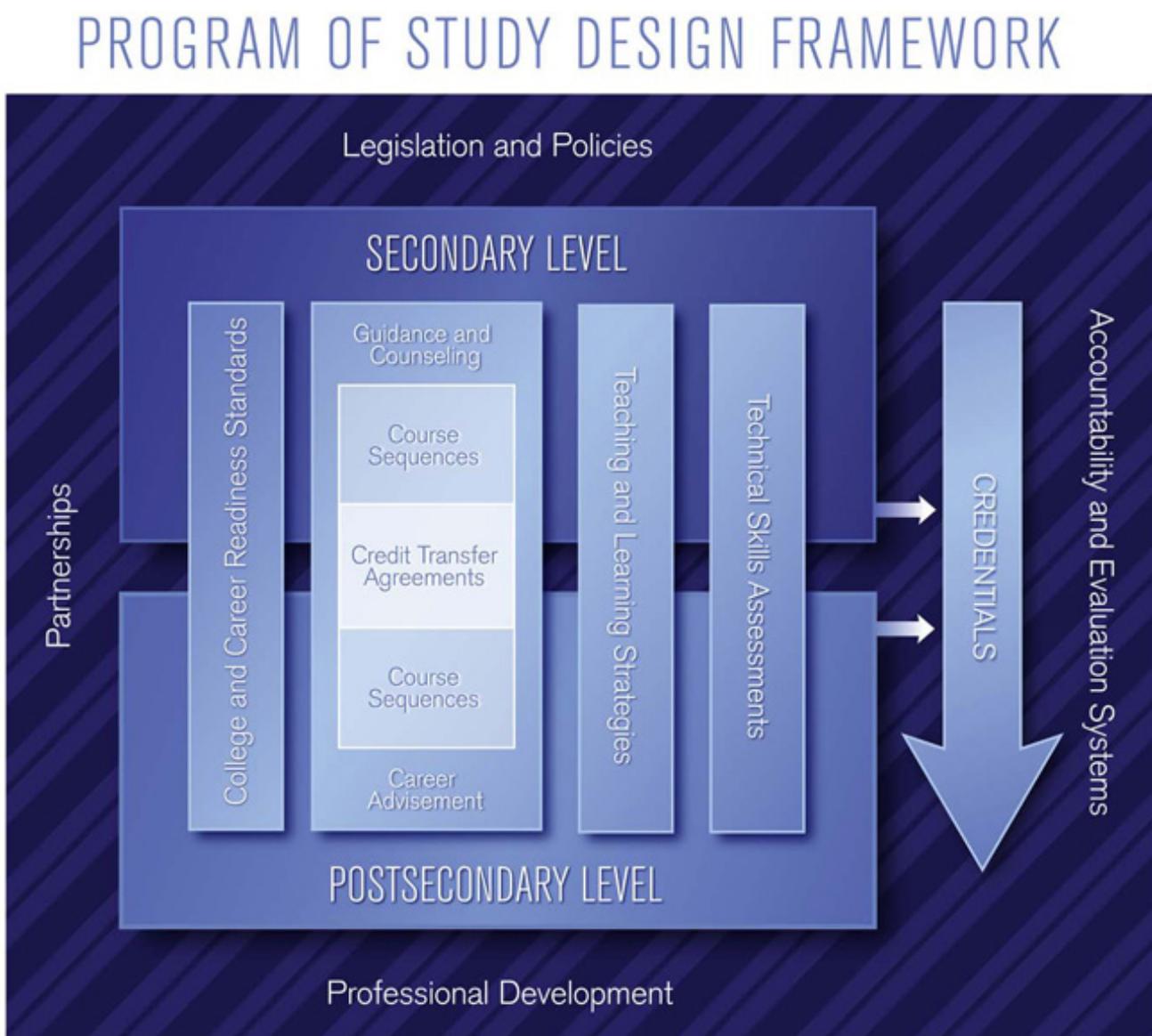
Source: Office of Career, Technical, and Adult Education. (n.d.). *Program of study design framework.* Retrieved from http://cte.ed.gov/nationalinitiatives/rposdesignframework.cfm

Also, at the time of writing this guide, the Center for Law and Social Policy, Inc. (CLASP) and the Alliance for Quality Career Pathways (AQCP) have jointly released a draft framework for review by the public (AQCP, 2013). It is anticipated that "Version 1.0" of the framework will be released in 2014. This document appears to be quite promising and pertinent in several respects. Its contents include key definitions, guiding principles, and criteria for state and local career pathway systems, as well as comprehensive frameworks for developing and documenting high quality systems. As well, it includes career pathway metrics and comments. Notably, 10 states—including Illinois—are leading the nation as part of the Alliance. Each state, in turn, aims to develop and scale career pathways. programs of study, it would appear, can and should be viewed within the larger context of enabling career pathways that are aimed to "optimize the progress and success of individuals" throughout their lives, while at the same time "help(ing) states and communities strengthen their workplaces and economies" (AQCP, 2013, p. 2).

Where possible, we highlight the interconnections between these frameworks and the guiding principles outlined in the *Illinois Programs of Study Guide* (2009). Generally, this supplement will aim to integrate Illinois-specific and national information (e.g., the OVAE design framework [2010] and the AQCP framework [2013]) to provide a helpful, user-friendly resource for educators. Our intention is to support your efforts to develop, implement, and refine outstanding programs of study.

Why Develop and Implement High Quality STEM Programs of Study?
In an evolving and highly demanding labor market, creating relatively seamless secondary-to-postsecondary transitions and career pathways is increasingly recognized as essential, both at individual and societal levels (Symonds, Schwartz, & Ferguson, 2011). Whereas previously a high school diploma offered a sufficient passport to a wide variety of careers, increasingly a postsecondary degree and/or certificate completion is requisite. In the United States, on a macro level, this gap between current and desired postsecondary degree and certificate completion rates has attracted much attention and largely reflects what some have coined the "educational pipeline" problem. Recognition of this growing problem, in turn, has motivated a variety of intended programmatic and policy remedies (Bragg, 2011; Ewell, Jones, & Kelly, 2003). Accordingly, programs of study are designed to align and unify students' educational experiences and create smoother pathways from high school to college and career (Bragg & Durham, 2012). Ideally, students select and complete these programs in a manner that is consistent with their talents, goals, and interests (Lewis et al., 2008). Moreover, program of study selections and offerings should be context-sensitive decisions that reflect local and broader labor market considerations, and that leverage business partnerships to offer students unique work-based opportunities. These features potentially set programs of study apart as a powerful approach for improving students' immediate learning experiences and long-term outcomes.

From theoretical perspectives, programs of study are promising for a number of reasons. First, they are conducive to real-life, contextualized learning (Shumer & Digby, 2012), and learning tends to occur in domains of special interest for students. Moreover, these experiences include the potential to facilitate adolescents' identity development. Students in mature programs of study engage in career exploration and experience hands-on and project-based learning (Lewis et al., 2008). Much theory and research supports the superiority of learning opportunities that include these features (Bransford, 2000). Ultimately, students gain a genuine sense of what it is like to do certain types of work, and what skills are requisite and supportive. Their appetites are whetted (Bragg, 2012) as they begin to envision and move toward future college and career options.

Programs of Study, in State and National Perspective (continued)

Demands upon today's education and workforce development systems (AQCP, 2013) differ from, and are greater than, past demands; now, credentials are required by nearly two-thirds of the workforce (Carnevale, Smith, & Strohl, 2010), lifelong learning is now more so a necessity than a preference (AQCP, 2013), and education beyond high school has perhaps never been more important (e.g., Pew Report, 2014). As such, seamless and high quality programs and pathways between and across educational institutions and the workforce are requisite, to serve both individuals and the broader society.

Specific to the STEM areas, programs of study might take on heightened significance in light of the widespread viewpoint of the importance (both to the individual and to society) of developing/possessing requisite STEM-related skills. For instance, the U.S. Department of Commerce reports that that STEM jobs will continue to grow at rates far exceeding their non-STEM counterparts: They have projected STEM occupations to grow by 17% from 2008 to 2018, versus 9.8% growth for non-STEM occupations (Langdon, McKittrick, Beede, Khan, & Doms, 2011). Meanwhile, research suggests a pressing need to improve exposure and pathways for underrepresented students, including females, into STEM fields (Turner & Lapan, 2006; Willms, 2006). Trends and projections such as these underscore the potential benefits of working concertedly to engage a diverse student population in STEM education. In the absence of these efforts, labor needs will be unmet and students' future prospects will be limited.

Thus, it is easy to see why programs of study are encouraged from numerous perspectives. Yet, their terrific complexity and multi-faceted nature will soon become obvious. We hope that this document will be assistive in terms of providing an organizing framework for approaching this challenging but rewarding work. While the six guiding principles (and accompanying design elements, information, tools, and resources) from the *Illinois Programs of Study Guide* (2009) form the foundation of this document, we also draw in other resources where appropriate.

Overview of Guiding Principles and Design Elements

In the *Illinois Programs of Study Guide* (2009), information is organized by principle, with each containing the following:
- a guiding principle statement;
- a brief overview of the "what, why, and how" of each guiding principle;
- an "In Practice" example;
- a description of the relationship of the principle to Perkins IV language;
- design elements at a glance;
- tools and resources; and
- appendices.

In this summary document, we take a slightly different and more abbreviated approach. Per principle, we include:
the guiding principle statement:
- a brief overview;
- a listing of associated Design Elements, presented as "Design Elements at a Glance;"
- a section aimed to highlight interconnections with other materials and findings, presented as "Connections of Principle X to Other Programs of Study Literature;"
- a vignette depicting carryout of the principle "in practice," presented as "Principle X In Action;" and
- questions for consideration based on the vignette.

The reader is referred to the full guide for greater detail whenever desired. First, let us review the six principles altogether, before taking a more in-depth look at each principle:

The Six Guiding Principles

Principle 1: Leadership, Organization and Support

Principle Statement: Programs of Study are developed, supported and led with guidance from collaborative partners.

Principle 2: Access, Equity and Opportunity

Principle Statement: Each and every student has access to educational opportunities and services that enable their success.

Principle 3: Alignment and Transition

Principle Statement: Education and training providers, with input from business and industry, enhance alignment that facilitates student preparation and transition through the educational pipeline.

Principle 4: Enhanced Curriculum and Instruction

Principle Statement: Curriculum and pedagogy involve rigorous and relevant instruction that enhances learning and enables students to attain academic and technical standards and credentials.

Principle 5: Professional Preparation and Development

Principle Statement: Comprehensive and continuous professional development that impacts teaching and learning is delivered to enhance the recruitment, preparation and retention of qualified instructional and administrative staff.

Principle 6: Program Improvement and Accountability

Principle Statement: Data are collected, shared, and utilized to improve outcomes and demonstrate accountability.

Source: Taylor, J. L., Kirby, C. L., Bragg, D. D., Oertle, K. M., Jankowski, N. A., & Khan, S. S. (2009, July). *Illinois programs of study guide*. Champaign, IL: Office of Community College Research and Leadership, University of Illinois. Retrieved from http://pathways.illinois.edu/?page_id=372

Principle statement

Programs of study are developed, supported, and led with guidance from collaborative partners.

Principle Overview

Development and refinement of a Program of Study is a complex form of systems change requiring the engagement and collaboration of a variety of stakeholders. Ultimately, its success is predicated upon the efforts and alignment of various individuals and systems. Thus, "shared leadership, organizational change and strategic support" for programs of study are critically important. Indeed, leadership (in its various forms) is arguably *the* central ingredient to the successful development, implementation, and evaluation of programs of study.

On reflection, it appears that leadership will weave through all aspects of program of study development, implementation, and evaluation. Without it, rigorous programs of study simply will not be developed and continuously improved. Let us elaborate on this point. If you are in administrative position (e.g., a school principal or assistant principal, or a curriculum director), you may be centrally positioned to carry out or facilitate numerous important functions. First, you might have the opportunity to build a common vision and mission, one that includes rigorous programs of study to promote students' identity development and their career and college readiness. In the STEM area, you can rely upon numerous findings and projections (e.g., Langdon et al., 2011, as described previously) that underscore the tremendous importance of student preparation in these areas. Related, you may be troubled by a separation across CTE and "academic" coursework or "tracks" that has unfortunately been common in many schools, and you may see and be able to convey this as a means of bridging instruction and programming to the benefit of students.

Second, you may have the capacity to bring various potential and existing partners together to create the best possible programming and solutions for students. This will be discussed in more detail as part of Principle Four. The establishment of a multi-partner advisory committee is seen as a critical step from the onset, and you are probably best positioned to take the lead on establishing and/or facilitating it.

Third, you are likely in an enviable position of seeing the "big picture" with respect to your school, including your faculty, facilities, students, and community. You are privy to a good deal of information, and you are positioned to synthesize this information in a way that will maximize opportunities for students. For instance, you may possess knowledge about access or equity issues for students in various programs in the school, and you may begin to see potential means of improvement. Still, this will connect back to the prior points; you will need to work with a variety of stakeholders to build consensus, share responsibility, and forge a common plan.

Fourth, you likely possess a measure of influence and authority that will allow you to support program development. For instance, you may be able to allocate budgetary resources to the purchase of necessary materials, and you may be able to strategically plan and schedule the school day and academic calendar, creating time and opportunity for collaborative, inter-departmental meetings.

Lastly, you are likely in a position to promote and ensure rigor of programming, accountability on the part of responsible faculty and staff, and troubleshoot and clear roadblocks that emerge along the way. Your willingness to roll up your sleeves and work with these program(s) will go a long way toward ensuring their success.

Thus far, we have been considering leadership from the vantage point of a person in a formal position of leadership. This perspective might help for some readers, but is limiting as well. Increasingly, it is known that leadership can emerge at all levels and positions. Certainly, the administrative leader has an important role in promoting leadership distribution, especially within the context of such a complex and multi-faceted undertaking as this, yet it is unrealistic to expect that one person, acting alone, could carry out all of this work: Faculty members, acting individually and in concert to develop and refine curriculum, will serve as leaders. Counselors, providing expertise with respect to student development and helping to guide students into individualized programs, will serve as leaders. Community business partners, who help to establish internships and work-based experiences, will serve as leaders. More importantly, those impacted by these decisions are highly unlikely to fully commit themselves to this important work if they are not integrally involved in the process and have these decisions thrust upon them. Thus, shared or distributed leadership seems a particularly promising perspective. The *Illinois Programs of Study Guide* (2009) provides an introduction to this perspective on leadership, as well as two others that may hold special relevance: transformational and transformative leadership.

Connecting Principle One to Other Programs of Study Literature

Stipanovic, Shumer, et al. (2012) conducted a comprehensive evaluation of Program of Study implementation and helpfully identified six central themes or findings that are common across sites that featured highly implemented Programs. As suspected, each of these appears to be interrelated with (and perhaps even impossible without) excellent leadership practice. For instance, these sites were characterized by engagement of school personnel and a focus on learning, which was promoted by collaborative cross-disciplinary planning time and use of facilitative course scheduling methods. Also, knowledge and skills were certified and education proceeded seamlessly from high school to community colleges, which suggests strong partnerships and great leadership spanning both types of institutions of learning. Meanwhile, investigators report the importance of teacher "champions" (Hammond et al., 2013) and faculty/ staff initiative and commitment (Alfeld & Bhattacharya, 2012) to the process. Notably, Alfeld and Bhattacharya (2012) emphasized the centrality of guidance counselors and asserted that counselors' engagement (generally speaking) with programs of study should increase. Similarly, as we review this principle in relation to the OVAE framework, it is easy to see the necessity of leadership across most, if not all, elements. In sum, it is clear that exemplary, rigorous programs of study cannot be developed, sustained, and improved absent of solid, continual, and shared leadership.

Throughout this guide, these hypothetical scenarios will serve to illustrate important actions associated with each Guiding Principle.

Design Elements at a Glance

The 2009 Program of Study Guide specifies the following eight design elements associated with this principle and includes helpful resources within each. The reader is strongly encouraged to consult this guide and pursue these resources as needed.

1. Leaders support **authentic collaborative partnerships** that include secondary and postsecondary education and encourage the active involvement of business and industry and labor organizations; community-based organizations and community members; student organizations; parent organizations; and other organizations and agencies that benefit student transition to college and careers.

2. Leaders establish and communicate a **vision, mission, and goals** that are aligned with enabling federal and state policies and important components of the larger educational system.

3. Leaders encourage individuals at all levels to engage in **shared decision making**, encouraging the perspective of individuals and groups not always active in curriculum reform and organizational change.

4. Leaders nurture a **collaborative culture** of respect, high expectations, and demonstrable student outcomes and benefits for partners.

5. Leaders formalize genuine collaborative partnerships, including the roles and responsibility of member entities and create a formal **memorandum of understanding** to ensure clarity and accountability.

6. Leaders encourage the planning, implementation and evaluation of Programs of Study that are guided by active, **joint secondary-postsecondary advisory committees**.

7. Leaders commit **tangible and intangible resources** including personnel, money, curriculum, technology, encouragement, and moral support.

8. Leaders encourage that partners receive **technical assistance and technology assistance** to support Program of Study implementation and continuous improvement.

Principle 1 in Action

The principal of Jefferson High School, a firm believer in the power of rigorous programs of study for students, has taken the first steps toward their development. She has begun conversations with teachers in a number of departments–math, science, and agriculture–to gather their thoughts. She was pleased to be met by initial enthusiasm, but she noted that real collaboration would require efforts and supports on her part to ensure common planning and articulation time.

Importantly, the principal also formed a Program of Study Selection Committee, which included a variety of stakeholders (teachers, two district office members, business partners, a community college leader, and two interested parents). Early on, the principal successfully presented a broad view of why this work was necessary, and the group began to coalesce around a common mission. The principal helped the committee to recognize and seize the opportunity to identify career cluster(s) and program(s) of study that would align with market needs and student interests, and to capitalize on potential partnerships and existing programs. This process proved to take a fair amount of time, but it was worth it; the committee landed enthusiastically upon the selection of "Applied Horticulture, Horticulture Operations, General" as a program of study, part of the Agriculture, Food, and Natural Resources (AFNR) Cluster. Fortunately, some key pieces were already coming into place. A local business official pledged to offer assistance in terms of providing work-based learning and internship opportunities to a certain number of students, and the community college leader described several ways in which coursework could align and transfer.

These aforementioned activities, the principal believed, were foundational but mostly represented the beginning of a complex, lengthy process. She knew that she would be centrally positioned as a leader, a resource, and a support to a variety of stakeholders as the process would unfold. Her next step, she determined, would be to consider reconstituting the initial committee and/or forming a new committee to well represent those who would be most closely connected to the new program of study as it was being developed.

Questions for Consideration

- In what ways did the principal demonstrate leadership?
- Why did the principal form and facilitate a Program of Study Selection Committee?
- Why are school principals pivotally positioned as leaders of efforts to select, develop, implement, and evaluate programs of study?
- The principal is encouraged, yet believes that much more will need to be done? Do you agree?

Principle 2: Access, Equity, and Opportunity

Principle statement

Each and every student has access to equitable educational opportunities and services that enable their success.

Principle Overview

The quality of one's education is strongly connected to his or her future employment prospects and life outcomes. Unfortunately, its benefits have tended to confer disproportionately to certain students, at the expense of historically under-represented groups, including ethnic and racial minority students, students with disabilities, and first-generation college students (*Illinois Program of Study Guide*, 2009). Related, within schools, sorting and tracking mechanisms have been all-too-common and enrollment in advanced coursework often correlates troublingly with student and family background.

Ultimately, educators are responsible for meeting the unique needs of *all* students. To do so often requires us to look carefully at the possibility that some of our traditional practices and structures differentially impact certain students in an undesirable way. When issues are uncovered, a unique combination of courage, resilience, and creativity often is required to address them. Courage is needed in order to engage in initial and sustained problem-identification and problem-solving conversations with important stakeholders. Resilience is important to forge ahead, even when faced with academic and structural challenges. Creativity is likely to be called upon when designing solutions, which may involve considering what is required to "recruit" and "retain" students from a variety of backgrounds. Ultimately, the search for equitable programming could carry you into a variety of realms, including advertising and information dissemination, identification of and partnership with outstanding role models, and curricular analysis and re-design.

Individualized Learning Plan (ILP) processes represent a powerful means for providing *all* students with a customized educational experience that meets their unique interests and needs. Thereby, these plans support students' achievement and growth. The reader is referred to a comprehensive implementation guide, written by Fox (2014) of the Pathways Resource Center. Also, the National Collaborative on Workforce and Disability for Youth (NCWD) has produced numerous helpful resources regarding policy and practice surrounding ILPs, which are accessible from http://www.ncwd-youth.info/ilp. Ideally, ILPs facilitate students' planning, course selections, and career exploration, which in turn directly relate to their enrollment and successful participation in programs of study that align with their interests and skills.

Related, Career and Technical Service Organizations (CTSOs) often provide students unparalleled opportunities to

enhance and deepen their learning as they engage in career exploration. School and district leaders therefore should sponsor these organizations and related activities. CTSOs in Illinois tied to specific content areas include: BPA, DECA, FBLA, FCCLA, FFA, HOSA, SkillsUSA, and TSA. Many student organizations have local, regional, and state competitions, which can motivate students to deepen their knowledge and understanding of the curriculum and career opportunities, as they represent their schools in these contests. Additionally, student organizations can help expose students to varied occupations within their identified career pathways. Students, in turn, develop workplace and leadership skills desperately needed by today's employers. It is important to consider these organizations from a lens of access and opportunity, contemplating who is accessing these programs and whether they appear to represent and respond to student interests.

Thus, considerations of access, equity, and opportunity should be central to the development, implementation and evaluation of programs of study. Cathy Kirby, an OCCRL colleague, recently completed a crosswalk of the *Illinois Programs of Study Guide* (2009) guiding principles in comparison to key components/elements of several other well-known career pathways frameworks, including the AQCP Framework (2013). Interestingly, she discovered that the Access, Equity, and Opportunity guiding principle is unique to the *Illinois Programs of Study Guide* (2009); moreover, equity considerations are particularly under-addressed elsewhere. Nevertheless, the authors of the guide continue to regard this principle as indispensable, and Pathways Resource Center is in full agreement. The design elements and associated tools for this principle are meant to assist you as you delve into and/or aim to address these critically important topics.

Connecting Principle Two to Other Programs of Study Literature

Three of the six central findings from Stipanovic, Shumer, et al. (2012) appear to relate directly to this principle, and others appear to relate as well. First, these sites evidenced systems developed to support learning. Barriers between academic and CTE teachers were absent or lessened, and collaborations regularly occurred. Second, these sites showed an increased understanding and respect of CTE. Students of all abilities were increasingly attracted to CTE. Lastly, high-quality teachers were both knowledgeable about their subjects and showed the capacity to integrate academics and CTE instruction, among other excellent qualities. Each of these features, in our view, assists greatly with addressing this principle.

In terms of the OVAE design principles, **professional development** stands out among several elements that may be leveraged to address equity, access, and opportunity. For instance, schools with highly implemented programs of study tended to focus upon the integration of academic knowledge and skills with applied learning. This type of work, done well, promises to break down some of the longstanding barriers that have existed between "academic" and CTE courses/paths.

Design Elements at a Glance

The 2009 POS guide specifies eight design elements associated with this principle and includes helpful resources within each. The reader is strongly encouraged to consult this guide and pursue these resources as needed. The design elements are listed in this section

1. Various strategies are used to recruit, enroll, and retain students including students who are **underserved, under-represented, and from special populations.**

2. Processes are in place to identify and overcome **gaps and barriers for learners** in order to foster access to education and inclusion in educational programs including flexible time and location of programs.

3. Processes are in place to assist students to overcome **barriers to initial entry or re-entry** into secondary and postsecondary education.

4. Appropriate **support services** are available to promote student success, help student become college and career ready, and meet their educational goals.

5. The physical, virtual, and learning spaces of programs and support services are **universally designed** to promote state-wide access to education and successful transition.

6. **Special population sub-groups** are clearly identified so that their progress and success can be quantified and compared with other populations.

7. Programs and support services reflect **learners' and their families'** perspectives and interests in education and transition while addressing changes in resources and family role across settings.

8. Students have **access to networks and resources** to assist with curriculum, their career exploration opportunities and work-based learning.

Principle 2 in Action

Mr. Thomas, an assistant principal of a mid-sized high school, has have been given primary responsibility of overseeing your school's recently developed Program of Study in computer programming. There is much to be proud of, but he and a few others have noticed and become concerned about enrollment patterns: It has become clear that the coursework is disproportionately being accessed by male students. Also, the students are disproportionately White, with low relative representations of African American and Hispanic students. (at the expense of the school's African American and Hispanic populations).

The assistant principal determined that a best first step would be to share his concerns with the teachers most closely involved in implementing the program. Upon doing so, he was pleased to note that the teachers were generally in agreement with your concern (they, too, have noticed and reflected upon it to some degree), and they expressed a willingness to examine the program, including its curriculum and other features, from an equity perspective. Also, together they determined to make the immediate step of altering and increasing their advertising and awareness-raising efforts regarding the program for soon-to-be incoming freshmen and their families. They implemented this strategy because they suspected that lack of awareness or misunderstanding on some families' parts regarding the program was part of the problem. Upon returning to his office, the assistant principal began to wonder if surveying or informally speaking to current students might represent another important step.

Questions for Consideration

- How might this situation have differed if the teachers responded less agreeably to the assistant principal's concern?
- What internet resources might help the assistant principal to understand and aim to overcome the pattern that he has observed with respect to computer programming course enrollment?
- Aside from the steps discussed in this short vignette, what else might be done to aim to address and change these inequitable enrollment patterns?
- What else do you wonder about, that was not addressed within the vignette?

Principle 3: Alignment and Transition

Principle statement

Education and training providers, with input from business and industry, enhance alignment that facilitates student preparation and transition through the educational pipeline.

Principle Overview

At key transition points, it has been shown that too many students' educational paths end or are deferred; these transition points include graduation from high school and entry into postsecondary education, and continuation of postsecondary education via transfer from a two-year to a four-year college or university. For many students, transitions present exit points that may represent a premature and undesirable end to their educational pursuits. Moreover, students' deferred or truncated education represents missed opportunities for individuals and for society at large.

The successful transition between high school and postsecondary education or high school and career is paramount; indeed, programs of study are intended to strengthen such transitions. Increasingly, it is understood that enhanced alignment within and across systems acts to facilitate the transition for students. Fundamental to this process is continuous partnership and articulation to assure that the programming within and across systems coheres and culminates in some valuable outcomes. Moreover, agreements should be forged so that credits earned while part of one system will be recognized and transferred into another system and that credentials are stackable. When credentials are stackable, they can be accumulated over time by individuals as they increase their qualifications, enabling their movement along a career pathway into related, and potentially more complex and higher paying, jobs.

In Illinois, several STEM Learning Exchanges, organized by career cluster, exist to support local development and implementation of P-20 STEM programs of study. They are unique and innovative partnerships between public and private entities. Depending upon the specific programs of study chosen in a school or a district, one or more Learning Exchanges will likely represent a crucial point of contact. The Learning Exchanges are equipped to provide support in terms of alignment and transition, as well as support in the area of curriculum development/refinement. They may also serve to facilitate connections between entities that may be pursuing common goals, sometimes without knowing it. For more information, the reader is referred to the Illinois Pathways website (http://www.ilpathways.com).

Alignment and integration of curricula is crucial to this work; in this vein, the Office of Community College Research and Leadership's (OCCRL) *Curriculum Alignment Module* (Mordica & Nicholson-Tosh, 2013) is a resource that we highly recommend for anyone who is engaging in this work within programs of study. Ultimately, aligned curricula enable progressively more high-level learning to occur over time and increase the odds that students will successfully transition from high school to college and/or careers.

Principle 3: Alignment and Transition (continued)

Connecting Principle Three to Other Programs of Study Literature

One of the six central findings from Stipanovic, Shumer, et al. (2012) was that highly implemented programs of study always reflect seamless and well-articulated education connecting secondary to postsecondary education. Partnerships at these sites took a wide array of forms. Advisory committees were highlighted as among the most valuable partnerships, as they facilitated course and curricular design, the identification of certifications, and up-to-date local employment information. Related, the OVAE design elements include **college- and career-readiness standards**, **course sequences**, **credit transfer agreements**, and **guidance counseling and academic advisement**. Each of these elements includes focus upon alignment and is aimed to facilitate student transitions and improve their future prospects.

Design Elements at a Glance

The 2009 POS guide specifies eight design elements associated with this principle and includes helpful resources within each. The reader is strongly encouraged to consult this guide and pursue these resources as needed. The design elements are listed in this section

1. Non-duplicative curriculum is ensured through **secondary and postsecondary collaboration** for greater efficiency and alignment.

2. Course content and credit are aligned through **articulation agreements** which lead to industry recognized credentials and/or certification.

3. Curriculum is aligned with relevant **educational, state, and industry standards and certifications.**

4. Programs are designed with **multiple entry and exit points** to high-skill, high-wage, or high-demand occupations and encourage stackable credentials.

5. Programs include development of a **coherent sequence of courses and programs** that may lead to the baccalaureate degree.

6. **Data-sharing agreements** are developed for program improvement, program reporting, and the evaluation of student transition across educational levels to provide necessary support services and ensure student success.

7. Programs provide students with multiple opportunities to build and/or increase their **"college knowledge"** in order to make informed decisions about educational and occupational options.

Principle 3 in Action

Mr. Rodriguez, Assistant Superintendent of Curriculum and Instruction, recognizes the importance of two major potential partners in his high schools' development of a STEM Programs of Study: a nearby Toyota plant, the largest employer in the area, and the nearby Crown Community College. He suspects that his initial contact with key representatives of these entities will be pivotal; he wants to make a good impression and convey a vision that will be mutually beneficial.

First, Mr. Rodriguez informally surveyed colleagues and learned about some helpful connections to leaders at both sites: a top executive in Toyota, he learned, is a close friend of a veteran math teacher; moreover, the community college President is married to a nurse's assistant in the middle school! These colleagues help to connect you to these individuals, and you have an opportunity to begin to forge partnerships. All parties agree in principle about the potential payoffs of improved partnerships, and a number of ideas are immediately advanced. With respect to the community college, for instance, it is clear from the outset that informal and formal connections generally are lacking, which can be problematic for both institutions and for local students who wish to matriculate. The Toyota executive, meanwhile, conveyed that her business could host several high school students for work-based experiences and also might be able to support some means of mentoring students who are interested in exploring related careers. Meanwhile, she provides a sketch of what she feels are the most "in demand" areas of her industry, and even shares some of the skills most needed within these areas. Most importantly, all individuals agree to be part of a committee that is being established, and/or to nominate top representatives of their institutions. The Assistant Superintendent is overjoyed, sensing that the high schools have just begun to forge fruitful partnerships that will eventually enhance the quality and cohesion of student programming.

Questions for Consideration

- In this case, Mr. Rodriguez was able to capitalize upon informal links between employees of the different entities. What might you do if you wish to explore the possibility of similar links in your situation?
- How would you advise Mr. Rodriguez and the Toyota executive to move from ideas to action in terms of the potential work-based learning opportunities?

Principle 4: Enhanced Curriculum and Instruction

Principle statement

Curriculum and pedagogy involve rigorous and relevant instruction that enhances learning and enables students to attain academic and technical standards and credentials.

Principle Overview

Here, the focus is upon curricular and instructional strategies, aligned and integrated so as to enable students to attain standards and credentials. Cluster-level orientation courses should provide a rigorous foundation for students, one that prepares them for more advanced content and coursework that they will encounter later. These courses, in turn, should include meaningful and repeating opportunities for students to use pertinent technologies. Meanwhile, business, industry, and community partners should work together to provide relevant instructional and work-based learning opportunities. Related, CTSO's are critically important because they tend to naturally facilitate applied learning opportunities.

This work is particularly significant as policymakers and educators have aimed to address the unfortunate reality that academic and CTE subjects have tended to be separated, with the latter subjects accorded a lesser reputation. Increasingly, it has been recognized that this separation is harmful and fails to provide the combination of technical knowledge and critical thinking and communication skills that are needed within a knowledge-based economy: Students need rigorous academic and technical preparation. Well-aligned, applied content and learning opportunities are necessary to meet these needs.

Curriculum mapping (e.g., Jacobs, 2006; see *Illinois Programs of Study Guide*, 2009) and a focus on transitions within and across educational systems are key to this process. Promising approaches include collaborative design and articulation between orientation and training level courses, and opportunities to earn dual credit while in high school. The assessment of academic and technical skills is crucially important. Wiggins and McTighe's (2005) *Understanding by Design* offers a potentially useful means of developing assessments by using "backward design." Wiggins and McTighe argue that assessments must be developed *before* the design of lessons and activities; in this process, educators understand essential course content and learning experiences that are necessary to assist students with mastering the curriculum.

Connecting Principle Four to Other Programs of Study Literature

Principle Four relates closely with two central findings in highly implemented POS's as reported by Stipanovic, Shumer, et al. (2012). First, systems were developed with the clear intention to support learning. Quality instructional design includes strategies such as building in sufficient time for educators to engage in lesson and project planning and adjusting course schedules to ensure that the programs are most conducive to student learning. Second, high-quality teachers invariably are reported to have made a difference in POS delivery. This fact speaks to the importance of attracting and retaining excellent teachers and of providing supports and resources to these teachers to facilitate continued growth.

Design Elements at a Glance

The 2009 POS guide specifies eight design elements associated with this principle and includes helpful resources within each. The reader is strongly encouraged to consult this guide and pursue these resources as needed. The design elements are listed in this section

1. Programs **integrate** academic and career and technical content to create contextual **instruction** that engages student interest and improves learning outcomes.

2. Programs infuse **career exploration, development and guidance** throughout the educational system.

3. Programs strongly encourage **dual credit opportunities** in career and technical education and academic courses to accelerate student learning and encourage transition to and success in college-level occupational programs.

4. Programs involve **business, industry and community partners** to provide relevant instructional opportunities (e.g., work-based learning, access to current technology, mentoring and leadership development, cross-cluster projects).

5. Programs' cluster-level orientation courses have a rigorous foundation of **CTE and academic content** that prepares students for more advanced academic and training level CTE courses.

6. Curriculum and pedagogy are designed to include the rigor and support services necessary to reduce the need for **remedial/developmental education**.

7. Programs include **multiple measures of assessment** designed for diverse learning styles that accurately determine acquisition of both academic and technical knowledge and skills.

8. Programs develop, improve or expand the use of **technology** to foster students' technical skills and reach more learners.

Principle 4 in Action

Upon selecting the Health Sciences career cluster and a program of study in nursing, it was evident to the high school faculty and their partners that an initial, orientation-level course for students was lacking. Educators and industry leaders eagerly partnered to develop a course. The industry leaders were instrumental in providing inside information on the most essential knowledge and skills for those entering Health Science careers. This information, in turn, provided a solid foundation from which a team of educators and parents could begin to develop the curriculum. They began work in December, with the goal of developing and delivering a course in the upcoming fall. To do so, they made great use of the Curriculum Alignment Module (Mordica & Nicholson-Tosh, 2013), among other resources, and also benefited from several discussions and guidance from a local school district that was already offering a similar course.

Perhaps most importantly, they connected with the Illinois Health Science Learning Exchange. Here, they were guided tremendously in terms of specific content, lessons, and curricular ideas. They also relied on the building leadership to develop a schedule, interface with the district office, and assist with meeting all other logistical and material needs. Happily, the course was offered in three sections in the fall, as had been hoped!

Questions for Consideration

- Why might non-educators, who are currently employed in a given industry, still sometimes be well-positioned to provide important information and feedback regarding curriculum development?
- Which entity in Illinois is particularly helpful in terms of developing curriculum?
- What roles of the building leadership were highlighted here, and what other roles for principals could be envisioned?
- How and why might school counselors be involved in these processes?

Principle 5: Professional Preparation and Development

Principle statement

Comprehensive and continuous professional development that impacts teaching and learning is delivered to enhance the recruitment, preparation and retention of qualified instructional and administrative staff.

Principle Overview

Professional development "serves as the bridge between where prospective and experienced educators are now and where they will need to be to meet the new challenges of guiding all students to higher standards of learning and development" (U.S. Department of Education, 2000, n.d.). Professional development assists educators with remaining current, developing/enhancing skill sets, and creating/sustaining a culture of continuous improvement. Development opportunities provided for educators should be coherent, sustained, and comprehensive (Taylor et al., 2009).

Effective professional development often includes the following qualities, according to Kedzior and Fifield (2004):

- Content-focused: Focusing on subject matter considering students' prior content knowledge
- Extended: Spanning a period of time, rather than single sessions
- Collaborative: Including peers, external researchers, program developers, and others
- Part of daily work: Integrating with day-to-day activities
- Ongoing: Including follow-up and support for advancement
- Coherent and integrated: Aligning with teachers' goals, standards, and assessments
- Inquiry-based: Promoting ongoing inquiry and reflection
- Teacher-driven: Responding to teachers' needs and interests
- Informed by student performance: Analyzing and using student outcomes data
- Self-evaluation: Incorporating reflective activities to guide development

Likewise, Guskey (2000) reviewed 13 lists of effective professional development, and he identified three frequently cited elements: starting with standards regarding intended participant learning outcomes; aligning professional development with other reform initiatives; and offering professional development that is ongoing, career embedded, and sustained.

With respect to programs of study, numerous pertinent topics may be addressed through professional development. Ideally, these professional development opportunities would take into consideration current areas of strengths, needs, and interests; and would be sustained and informed by information over time. The specific emphases may differ across sites, depending upon the areas of need.

Connecting Principle Five to Other Programs of Study Literature

Effective teaching is the single-most important factor in enhancing students' learning and achievement (Hanushek, Kain, & Rivkin, 1998), and professional development is a primary means of influencing classroom teaching and learning practices. Unsurprisingly, high-quality teachers are singled out as one of the six central findings in a highly-implemented POS (Stipanovic, Shumer, et al., 2012);

meanwhile, the other elements conceivably are addressed (at least in part) via professional development. For instance, seamless integration requires collaboration of teachers and unified vision/strategy, which can be attained when teachers are working under similar expectations and assumptions. Professional development offers an opportunity to develop a common mission and vision, and to build lessons, assessments, and other approaches to support them.

Design Elements at a Glance

The 2009 POS guide specifies eight design elements associated with this principle and includes helpful resources within each. The reader is strongly encouraged to consult this guide and pursue these resources as needed. The design elements are listed in this section

1. Professional development activities are coordinated with **teacher certification or licensing, in-service and pre-service** learning, other related professional development activities, or current local reform initiatives/school improvement plans.

2. Professional development activities are high-quality, sustained, intensive, **comprehensive, and instruction-focused in order to have an impact on classroom instruction.**

3. Professional development is designed to help all partners and stakeholders improve the **quality of instruction** in order to impact student achievement and meet the state annual adjusted level of performance (AALP).

4. Local leaders conduct **needs assessments** prior to designing professional development and involve stakeholders and partners in collaborative planning.

5. Professional development combines resources with other regions and organizations to **maximize resources.**

6. Professional development includes the sharing of best or **promising practices** based on scientifically-based research and data that demonstrate program effectiveness.

7. Professional development includes opportunities for secondary and postsecondary educators to collaborate to encourage **curriculum alignment and integration.**

Principle 5 in Action

Throughout this guide, these hypothetical scenarios will serve to illustrate important actions associated with each Guiding Principle.

It is summertime, and a Principal, Assistant Principal, Assistant Superintendent, and several teachers and department leaders have scheduled a series of meetings in preparation for the upcoming school year. Numerous opportunities for professional development are built into the schedule, via District Institute Days and a small number of Late Starts. The team wished to consider how to best make use of these opportunities.

A key first step was to review results from a recent faculty/staff survey, as well as student achievement and outcomes data. These data were supplemented by more informal conversation by team members regarding perceived areas of strength and need. Soon, the group zeroed in upon "developing/implementing high quality STEM Programs of Study" as a broad topic, and they began to slice it down more finely. With the assistance of the school principal, they framed the discussion first in terms of standards ("What do we want to ensure that our students will learn and accomplish?") and allowed the resultant standards to drive subsequent planning. Over time, the team concluded that professional development would be provided around five broad areas: cross-curricular integration, setting performance targets and assessing student learning, career advising, work-based learning opportunities, and curricular alignment. They also set a tentative schedule and assigned roles/responsibilities for developing and facilitating each. Now that this work was complete, the team began to identify resources and design the professional development opportunities. Although much work remained, the team was feeling great about the new year and the prospects of strategically using professional development to improve the quality of learning in the school in the upcoming year.

Questions for Consideration

- What data did these educators rely upon to guide their discussion and planning, and why? Were they lacking certain information?
- Do you feel that the team identified a realistic amount of professional development work? Why or why not?
- How did they rely upon standards in this situation?

Principle 6: Program Improvement and Accountability

Principle statement

Data are collected, shared, and utilized to improve outcomes and demonstrate accountability.

Principle Overview

Even the best conceived programs require review and modification over time; advances and changes in a field, for instance, should be closely accompanied by changes to a Program of Study. Meanwhile, through review of performance indicators, a team may determine that certain changes are needed to assure that a program makes its intended impact. To best ensure accountability and program improvement, a team or advisory committee is often necessary; this team sets and monitors performance standards and identifies important internal and external trends and changes that might impact a Program of Study. Team members also may work closely across organizations to assure that data-sharing agreements are in place, so that important short- and long-term student outcomes can be tracked.

Program improvement is continuous and multiple models are available for prospective teams to utilize. The Pathways Resource Center's website includes a page describing and linking to several continuous improvement models (Pathways to Results, Rising Star, AdvancEd, and High Schools that Work). To learn more, the reader is referred to the page (http://pathways.illinois.edu/?page_id=1046).

Here, we also highlight and summarize 5-step program improvement process developed by the National Alliance for Partnerships in Equity in relation to the Science, Technology, Engineering, and Math (STEM) Equity Pipeline Project:
1. Documenting performance results: Describing performance on core indicators over time.
2. Identifying root causes: Analyzing performance data, additional information, and methods to determine causes of performance gaps.
3. Selecting best solutions: Identifying and evaluating potential solutions by examining underlying logic and evidence.
4. Pilot testing and evaluating solutions: Evaluating solutions prior to full implementation.
5. Implementing solutions: Implementing fully tested solutions and evaluate performance. (National Alliance for Partnerships in Equity, 2006)

This process is meant to repeat over time on the basis of the feedback that it generates. It is supported by activities such as professional development and ideally is supported by a variety of stakeholders who see it as their collective responsibility to review and utilize information to continuously improve programming.

Principle 6: Program Improvement and Accountability (continued)

Readers are advised to review and consider the use of Pathways to Results (PTR), an "outcomes-focused, equity guided process" that is aimed to "improve programs and policies that support student transition to and through postsecondary education and employment" (Bragg & Bennett, 2012, p. 1). It is highly developed and provides methods, tools and templates to address inequities in student outcomes and improve student, program, organization, and system performance. To learn more, readers are referred to: http://occrl.illinois.edu/projects/pathways/about-ptr/

Related, accountability is the practice of holding systems responsible for the quality of their outcomes (Taylor et al., 2009). Whereas continuous improvement works in parallel with formative evaluation, accountability is related more closely to summative evaluation. Both are important and are ideally linked to data-supported decisions.

Connecting Principle Six to Other Programs of Study Literature

The OVAE's Design Framework (2010) specifies the importance of accountability and evaluations systems as one of its 10 components, and highly implemented sites each included such systems. These sites all reported some difficulties with collecting reliable information across systems, thus underscoring the importance of data-sharing agreements and partnerships. Meanwhile, Professional Development and Partnerships and Collaboration are design elements that are part and parcel to the continuous improvement of programming.

Design Elements at a Glance

The 2009 POS guide specifies eight design elements associated with this principle and includes helpful resources within each. The reader is strongly encouraged to consult this guide and pursue these resources as needed. The design elements are listed in this section

1. All programmatic activities, including professional development are evaluated for improvement and accountability using **multiple forms of assessment and measurement.**

2. Data are used to inform a **culture of program improvement** that uses data to improve instruction and programs.

3. Data are used within the organization and shared with partners to foster **local improvement and regional development.**

4. Relevant **labor market data** are used to inform program development and implementation.

5. A data collection system is developed with the capacity to collect **longitudinal data** on core indicators, performance measures, and workforce placement.

6. Procedures are implemented to collect **reliable and valid data** at each educational level and point of data collection.

7. Partnerships set specific **performance targets** and establish measurable goals for participant outcomes based on state adjusted level of performance on each indicator and are responsible for meeting those targets or providing plans of improvement.

8. Collected data are **disaggregated and cohort based** to provide gap analysis on different student groups for purposes of equity.

Principle 6 in Action

With a program of study now underway in Agricultural Business Management, a wise Assistant Superintendent persuaded fellow Advisory Committee members that their work had only just begun! She argued that the POS would need to adapt with changing needs over time and may or may not achieve the desired outcomes. It would be best if a team took on the responsibility of managing information review and continual improvement processes. This, the Assistant Superintendent noted, is true of all school programming yet might be especially important in the case of a new program such as this one. The Advisory Committee members agreed to take on "program monitoring and improvement" among their key responsibilities, going forward. They considered the representation of the group for this purpose and agreed that they could use an additional faculty representative to round out their team. As a first step, they relied upon their written and stated program goals to define key performance indicators. They also considered which of these data would be readily available, and which would be more difficult. For more "difficult to come by" data, they devised means of getting it. In certain instances, this required drafting and forging data sharing agreements with local postsecondary institutions.

Next, the team drafted a tentative timeline for program review. Meanwhile, they studied a continuous program improvement model and determined to use it to assist this process. It felt good to the Assistant Superintendent and others to know that a support system for the program of study was moving into place.

Questions for Consideration

- Why did the Assistant Superintendent insist that monitoring and program evaluation would be necessary?
- Who should be involved in this type of work, and how should roles be distributed?
- What information was relied upon to establish performance indicators?
- What other considerations, not addressed in the vignette, would be essential to the success of this continual improvement effort?

Steps and Phases for Developing, Implementing, and Improving Programs of Study

In this concluding section, we consider the order and manner in which programs of study ideally might be selected, developed, and improved. Although it is certain that programs of study are not always developed and refined in a sequential, step-by-step fashion, it is still helpful to you and your teams to consider and plan an initial order in which to focus efforts. In 2011, two states' departments of education have released Program of Study guides that include phases (Wisconsin) or steps (Arizona) to follow. We summarize each, and briefly discuss ways in which they overlap.

Five Phases of the Program of Study Implementation Process (Wisconsin, 2011)
(Accessible from http://cte.dpi.wi.gov/cte_posguide)

In this guide, **five phases** are presented (p. 9) and fleshed out in significant detail (p. 10-28), including rubrics for self/team assessment of current status within each phase. The phases, as initially presented, are as follows:

Phase 1: Laying the Groundwork

Researching best practices and collecting data about model programs of study based on local labor market information.

Phase 2: Assembling a Team

Gathering a representative group of all stakeholders who will work together to guide the creation of a Program of Study.

Phase 3: Designing and Building a POS

After selecting a specific pathway, team members analyze curriculum and determine development and improvement needs. The outcome of this phase is a detailed plan for the implementation of the program of study.

Phase 4:Implementing the Program of Study

The detailed Program of Study plan is put in place and students enroll in the program and continue on to postsecondary education.

Phase 5: Evaluating and Refining the Program of Study

An evaluation plan is created that defines what elements are needed, how they will be collected, what the benchmarks of success are, and who is responsible for providing the improvements in the Program of Study. Considerations for refinement of the Program of Study after a strong evaluation.

These phases are described in great detail within the resource, which we highly recommend as a well-developed and organized set of ideas for teams at all phases of the POS process.

Steps for Establishing a Program of Study (Arizona, 2011)
(Accessible from http://www.azed.gov/career-technical-education/files/2011/06/program-of-study-implementation-guide.pdf)
In this guide, **seven steps** are outlined (p. 4-6), with substantial detail offered within each.

Step 1: Establish Partnership
This step includes the identification of stakeholders and partners, spanning secondary and postsecondary, business and industry, previous tech prep consortia, and others.

Step 2: Build the Program of Study Foundation
Here, a number of activities are undertaken, including: identification of an appropriate career pathway, selection of the program of study (on the basis of labor market data, established programs and prior work, etc.), identification of the CTE Secondary Program, and establishment of desired outcome/exit points (e.g., certification, licensure, and degree).

Step 3: Design the Program of Study
This step includes numerous activities and decisions. The reader is referred to the Arizona guide (pp. 4-5) for full detail.

Step 4: Develop Articulation/Dual Enrollments
This step includes review of credit options for secondary students to avoid duplication and improve the alignment of coursework across levels. Here, it is important also to attend to necessary certification requirements for teachers to be able to teach dual enrollment courses, as well as to consider financial arrangements. Lastly, a formal agreement should be constructed to allow secondary students to earn appropriate postsecondary credit.

Step 5: Implement the Program of Study
This step includes numerous activities and decisions; the reader is referred to this guide for greater detail. First, it is important to develop a marketing and recruiting strategy. Notably, guidance and counseling partner roles are highlighted for their importance in helping students establish plans, enroll in the proper courses, and understand the importance of completing particular course sequences. It is important to keep parents well informed about the POS and any dual credit opportunities

Step 6: Assessments. This step includes development of a strategy for administering college placement assessment at a proper point in time, ensuring that POS students take end-of-program Technical Assessments at the conclusion of their final course; and identification and use of postsecondary assessment for credentialing

Step 7: Evaluating and Improving the Program of Study. This step starts with the development of a joint secondary/postsecondary advisory board. Next, the 10 components of the Program of Study Design Framework (OVAE, 2010) should be considered in order to develop a plan for full implementation of each component (this, according to the authors, would allow it to become a "Rigorous Program of Study"). A process should be developed for annually evaluating the Program of study, including benchmarks. All partners and stakeholders should be involved in this evaluation and improvement work. Establishment of an evaluation rubric, to be used each year, is recommended.

Steps and Phases for Developing, Implementing, and Improving Programs of Study (continued)

Comparing these steps and phases, significant overlap and some minor departures are evident. For instance, the Wisconsin guide begins with Laying the Groundwork, whereas the Arizona guide begins with Establishing Partnership(s) (this is probably most closely related to phase two in the Wisconsin guide). Still, it is clear that authors of both guides saw the benefits of describing a sequence in which this work could occur, along with recognition that in real life the order and emphases may vary somewhat. We believe that information from both resources will be useful when considering a strategic approach to POS design, implementation, and continual improvement.

Conclusion

In this supplement to the *Illinois Programs of Study Guide* (2009), we have aimed to provide a user-friendly resource to support POS development and implementation, including a detailed process and suggested set of steps that can be followed. We have also aimed to highlight additional, helpful resources. We hope that this information has provided a measure of support to educators, administrators, and other partners who are engaging in complex and rewarding POS development and implementation work.

References

Alfeld, C., & Bhattacharya, S. (2012). Mature programs of study: A structure for the transition to college and career? *International Journal of Educational Reform*, *21*, 119-137.

Alliance for Quality Career Pathways. (2013, July 15). *Alliance for Quality Career Pathways "beta" framework: Public version*. Retrieved from http://www.clasp.org/issues/postsecondary/pages/alliance-for-quality-career-pathways

Arizona Department of Education. (2011). *Arizona career technical education: Program of study development and implementation guide*. Phoenix, AZ: Arizona Department of Education. Retrieved from http://www.azed.gov/career-technical-education/files/2011/06/program-of-study-implementation-guide.pdf

Bragg, D. (2011). Examining pathways to and through the community college for youth and adults. In *Higher education: Handbook of theory and research* (Vol. 26, pp. 355-394). New York, NY: Springer.

Bragg, D. (2012). Career and technical education: Old debates, persistent challenges in community colleges. In J. S. Levin & S. T. Kater (Eds.), *Understanding community colleges* (pp. 187-202). New York, NY: Routledge.

Bragg, D., & Bennett, S. (2012). *Introduction to pathways to results* (Rev. ed.).Champaign, IL: Office of Community College Research and Leadership, University of Illinois at Urbana-Champaign.

Bragg, D., & Durham, B. (2012). Perspectives on access and equity in the era of (community) college completion. *Community College Review*, *40*, 106-125. doi:10.1177/0091552112444724

Bransford, J. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Carl D. Perkins Career and Technical Education Improvement Act of 2006, Pub. L. No. 105-332, 250 Stat. 35 (2006).

Ewell, P., Jones, D., & Kelly, P. (2003). *Conceptualizing and researching the educational pipeline.* Boulder, CO: National Center for Higher Education Management Systems. Retrieved from http://www.nchems.org/pubs/docs/Pipeline%20Article.pdf

Fox, H. L. (2014). *Achieving their goals: Implementing an Individualized Learning Plan process to build student success*. Champaign, IL: Office of Community College Research and Leadership, University of Illinois at Urbana-Champaign.

Guskey, T. R. (2000). *Evaluating professional development*. Thousand Oaks, CA: Corwin Press.

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (1998). *Teachers, schools, and academic achievement.* NBER Working Paper No. w6691. Retrieved from http://ssrn.com/abstract=122569

H.R. 1532--112th Congress: Race to the Top Act of 2011. (2011).

Kedzior, M., & Fifield, S. (2004). Teacher professional development. *Education Policy Brief*, *15,* 1-6. Newark, DE: Education Research and Development Center, University of Delaware. Retrieved from http://biohealth.deanza.edu/dare/resources/professional%20development.pdf

Langdon, D., McKittrick, G., Beede, D. Khan, B., & Doms, M. (2011). *STEM: Good jobs now and for the future*. Washington, DC: U.S. Department of Commerce, Economics and Statistics Administration. Retrieved from http://www.esa.doc.gov/Reports/stem-good-jobs-now-and-future

Lewis, M. V., & Kosine, N. R. (with Overman, L.). (2008, October). *What will be the impact of programs of study? A preliminary assessment based on similar previous initiatives, state plans for implementation, and career development theory*. Louisville, KY: National Research Center for Career and Technical Education, University of Louisville.

Mordica, J., & Nicholson-Tosh, K. (2013). *Curriculum alignment module*. Champaign, IL: Office of Community College Research and Leadership, University of Illinois at Urbana-Champaign.

References (continued)

Office of Vocational and Adult Education (OVAE). (2010). *Career and technical programs of study: A design framework.* Washington, DC: U.S. Department of Education, Division of Academic and Technical Education. Retrieved from http://cte.ed.gov/file/POS_Framework_Unpacking_1-20-10.pdf

Pew Research Center. (2014, February). *The rising cost of not going to college.* Retrieved from http://www.pewsocialtrends.org/2014/02/11/the-rising-cost-of-not-going-to-college/

Stipanovic, N., Lewis, M. V., & Stringfield, S. (2012). Situating programs of study within current and historical career and technical education reform efforts. *International Journal of Educational Reform*, *21*, 80-97.

Stipanovic, N., Shumer, R., & Stringfield, S. (2012). Lessons learned from highly implemented programs of study. *Techniques*, *87*(1), 20-23.

Taylor, J. L., Kirby, C. L., Bragg, D. D., Oertle, K. M., Jankowski, N. A., & Khan, S. S. (2009, July). *Illinois programs of study guide.* Champaign, IL: Office of Community College Research and Leadership, University of Illinois.

Turner, S. L., & Lapan, R. T. (2005). Evaluation of an intervention to increase nontraditional career interests and career-related self-efficacy among middle-school adolescents. *Journal of Vocational Behavior*, *66*, 516-531.

U.S. Department of Education (2000). *Building bridges: The mission and principles of professional development. Goals 2000.* Retrieved from http://www.ed.gov/G2K/bridge.html

Willms, J. D. (2006). *Learning divides: Ten policy questions about the performance and equity of schools and schooling systems.* Montreal, Canada: UNESCO Institute of Statistics.

Wisconsin Department of Public Instruction. (2011, July). *A guide for implementing programs of study in Wisconsin.* Madison, WI: Wisconsin Department of Public Instruction. Retrieved from http://cte.dpi.wi.gov/files/cte/pdf/posguide.pdf

Appendix A: Curriculum Template

Curriculum Template _____ **Name of District** _____ **Name of Pathway** _____ **Program of Study** _____

Name of Cluster _____

Education Levels	Grade	English	Math	Science	Social Studies/Sciences	Other Required Courses, Recommended Electives, and Learner Activities	Career and Technical Courses and/or Degree Major Courses	Work-based Learning Experiences	Assessments/Certifications	SAMPLE Occupations Relating to this Pathway
Secondary	9					All plans of study need to meet **local and state** high school graduation requirements as well as college entrance requirements.				
	10									
	11									
	12									
					Interest Inventory Administered					
Postsecondary	Year 13					All plans of study need to meet learners' career goals with regard to required degrees, licenses, certifications or journey worker status.				
	Year 14									
	Year 15									
	Year 16									
					Articulation/Dual Credit Transcripted					

Source: Adapted from the Illinois Community College Board

A summary of Stipanovic, Shumer, & Stringfield's six central findings, presented as part of their study, "Lessons learned from highly implemented programs of study."

Six Central Findings (summarized):

Finding	Additional Information
Engagement	Staff and teachers were engaged; the power of POS is articulated: students "learn by doing" and become involved in authentic learning opportunities
A system developed to support learning	POS ensure learning as primary student activity, supported by appropriate systems, such as block schedules and collaborative planning time
Certification of knowledge and skills	CTE components result some form of industry-recognized certification; students also are expected to demonstrate academic knowledge in CTE contexts
Seamless Education	Importance well-articulated across secondary and postsecondary; POS link HS and community colleges, and students engage in a series of courses and activities
Increased Understanding and respect of CTE	POS appear to change traditional negative perceptions of CTE; students of all abilities attracted to CTE, especially when dual-credit opportunities are afforded
High-quality teachers made a difference in the delivery of POS	At all sites, attracting and retaining high-quality teachers was considered paramount; high-quality teachers were described as knowledgeable in the content area, able to integrate academic and CTE instruction, able to design and implement project-based learning opportunities, and able to establish and maintain positive student relationships

Note. These authors also considered high quality Programs of Study sites in terms of their relationship to the 10 components within OVAE's Program of Study Design Framework (2010). The reader is referred to this work for greater detail.

In summarizing their findings, the authors highlighted the pivotal roles of **collaboration** and **communication**. For instance, they highlighted the importance of collaboration high school and community college educators, and of regular communication and collaboration amongst academic and CTE faculty.

Stipanovic, N., Shumer, R., & Stringfield, S. (2012). Lessons learned from highly implemented programs of study. *Techniques*, *87*(1), 20-23.

Appendix C: Recommended Sites and Resources

Illinois Resources

- *Illinois Pathways (Science, Technology, Engineering, and Math) Website.* http://www.ilpathways.com/

- *Illinois State Board of Education Career and Technical Education (CTE) Website.* http://isbe.net/career/default.htm

- *Illinois programs of study guide.* http://occrl.illinois.edu/files/Projects/perkins/POSguide.pdf

- *Pathways Resource Center Website.* http://pathways.illinois.edu/

- *Achieving their goals: Implementing an Individualized Learning Plan.* http://pathways.illinois.edu/?page_id=928

- Pathways to Results (PTR) Landing Page. http://occrl.illinois.edu/projects/pathways/

National Resources/Resources from Other States

- *A guide for implementing programs of study in Wisconsin.* http://cte.dpi.wi.gov/files/cte/pdf/posguide.pdf

- *Arizona career technical education: Program of study development and implementation guide.* http://www.azed.gov/career-technical-education/files/2011/06/program-of-study-implementation-guide.pdf

- *Career and technical programs of study: A design framework.* http://cte.ed.gov/file/POS_Framework_Unpacking_1-20-10.pdf

- *AQCP Framework.* http://www.clasp.org/issues/postsecondary/pages/alliance-for-quality-career-pathways

- *STEM: Good jobs now and for the future.* http://www.esa.doc.gov/Reports/stem-good-jobs-now-and-future

The mission of the PRC is to provide resources and supports to secondary and postsecondary institutions, employers, communities, and other partners as they engage in successful and sustainable pathways for students from secondary, to postsecondary, to careers.

pathways
resource center