

5 *When linked to program review and improvement, program evaluation can help practitioners to ensure that career-technical education (CTE) and science, technology, engineering, and mathematics (STEM) programs offer equitable access and outcomes for underserved student groups.*

The Case for Evaluating Student Outcomes and Equity Gaps to Improve Pathways and Programs of Study

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New approaches to program evaluation are needed to ensure that career-technical education (CTE) and science, technology, engineering, and mathematics (STEM) education is assessing outcomes, improving programs, and demonstrating accountability. CTE has a long history of federal funding for program evaluation; however, measures and indicators have been inconsistently and inaccurately applied, and evaluation methods have varied widely (Klein et al., 2014). Changes are needed to ensure that program evaluation can assess the outcomes of all learner groups and contribute to program improvement. By emphasizing the way evaluation can assess outcomes for student subgroups, including disaggregating outcomes for students historically underserved by postsecondary education, it will be possible for program evaluation to produce information that closes equity gaps in access and outcomes.

This chapter begins with a description of how federal CTE legislation has conceived of evaluation for the purpose of program review and improvement. The discussion highlights an approach to program improvement that began in Illinois, called Pathways to Results, that integrates equity and outcomes assessment into local CTE program improvement. Demonstrating how practitioners use data to improve programs and enhance learner outcomes, the chapter ends with implications for evaluating both CTE and STEM education programs in the future.

Evaluation of Career-Technical Education

Federal policy on CTE has emphasized program evaluation for the purposes of performance reporting, accountability, and program improvement for decades. Released more than 10 years ago, the National Assessment of Vocational Education (NAVE; Silverberg, Warner, Fong, & Goodwin, 2004) report laid the groundwork for the current federal Carl D. Perkins Career and Technical Education Act of 2006, known as Perkins IV. Indeed, NAVE's comprehensive report on the 1998 Carl D. Perkins Vocational and Applied Technology Education Act (known as Perkins III) showed that postsecondary vocational education (now called career-technical education or CTE) had extensive national reach in terms of enrolling an estimated one third of all undergraduate students (and one half of all high school students), but these diverse individuals participated in highly varied ways to achieve different ends. Students who took more high school-level academic course work in conjunction with CTE classes tended to perform better than those taking fewer academic classes and CTE. Gender differences were detected in vocational course participation aligned with occupations stratified on income (e.g., early childhood and health care for females, manufacturing and information technology for males).

Although indicative of inequities among student groups, these results lack the kind of specificity that practitioners need to improve programs, calling for evaluation methods that disaggregate student outcomes by subgroup. This finding is further complicated by the fact that Perkins III dismantled set-asides for some special populations, including gender (e.g., elimination of the set-aside for state gender equity), coupled with fewer requirements for local agencies to direct funds to schools and programs that serve large proportions of special populations.

To this point, Silverberg et al. (2004, p. 15) noted a “weakening” of funding for high-poverty communities due to increased flexibility in funding provisions in the 1998 federal law. They also cautioned that the potential funding advantage that Perkins III intended for high-poverty districts was not realized in some districts; in fact, the extent to which CTE programs had served high-poverty districts declined since the 1990 federal law on vocational education was put in effect between 1990 and 1998. Whereas the federal accountability effort associated with Perkins III raised state-level commitment to accountability in some ways, state-supported program evaluation was weakened in other ways, with diminished emphasis on valid and reliable performance measures and inconsistencies in data collection and reporting being a primary contributor. Silverberg et al. ultimately concluded state systems could not “provide a reliable, national picture of vocational education performance” (p. 242). The problem of data quality was even more problematic at the local level where relatively few districts could implement robust approaches to program evaluation.

In 2006, the Carl D. Perkins Career and Technical Education Act (P.L. 109–270) was passed, representing continued federal commitment to CTE. Placing more emphasis on program improvement and accountability than the previous law, Perkins IV strengthened its focus on performance measures tied to the renewal of CTE programs of study. This law required that all states integrate academic and CTE subject matter into coherent programs of study. Students who participate in these programs are expected to follow a career pathway approach that assists them to transition from high school to postsecondary education and employment. In light of this policy, CTE researchers funded by the U.S. Department of Education grappled with ways to ensure that program evaluation would be strengthened in the current context. They observed that resources awarded through federal CTE funding have never been sufficient to address the immensity of state and national evaluation needs and that they were stretched even further under Perkins IV.

Kotamraju (2010) led an initiative for the National Center for Career and Technical Education (NCCTE) to improve program evaluation and accountability, including recommending a clearer definition of what it means to be a CTE student and meaningful measures of “the boundaries of his or her experiences” (p. 50). His working group recognized the importance of centering program evaluation on clear definitions of who participates in CTE programs so that it would be possible to attribute outcomes to student groups. Moreover, Kotamraju recommended that the federal government and states develop a standard data system to track CTE students’ progression into and through career pathways and programs of study to employment, with measures that convey student performance at major milestones and completion points. In calling for this change, Kotamraju recognized that student trajectories are not linear, noting students move back and forth between education and employment. He urged policymakers to take these complex patterns of enrollment and employment into account when measuring and interpreting student outcomes, in order to understand the impact of CTE programs.

In a closely related initiative, the National Association of State Directors of Career Technical Education Consortium (NASDCTEc) endorsed widespread dissemination of the National Career Cluster Framework that classifies occupations and industries according to career clusters, career pathways, and programs of study. This Career Cluster Framework provides a useful structure for program evaluation of CTE, though it does not appear to be used in this manner very often. Consistent with Perkins IV, this framework provides a means of classifying programs of study to assess whether they are meeting federal requirements to:

- Incorporate and align secondary and postsecondary education elements
- Include academic and CTE content in a coordinated, nonduplicative progression of courses

- Offer the opportunity, where appropriate, for secondary students to acquire postsecondary credits. Lead to an industry-recognized credential or certificate at the postsecondary level, or an associate or baccalaureate degree

Closely aligned is the Common Career and Technical Core (CCTC) that specifies common benchmarks that states should use to assess what students should know and be able to do after completing a program of study. Another framework of use to program evaluation is the Program of Study Design Framework that identifies 10 essential components that support implementation of CTE programs of study (POS), which are:

1. Legislation and policies
2. Partnerships
3. Professional development
4. Accountability and evaluation systems
5. College and career readiness standards
6. Course sequences
7. Credit transfer agreements
8. Guidance counseling and academic advisement
9. Teaching and learning strategies
10. Technical skills assessments

To evaluate these essential components, the NASDCTEc recommends that evaluation be aligned with the Data Quality Campaign (2009) that calls for matching student-level education and employment records to gather valid and reliable data on student outcomes. The NADSCTEc also emphasizes “timely data to evaluate and improve the effectiveness of POS” (n.d., p. 3). These recommendations represent good progress; however, nowhere in them is there a suggestion that program evaluation should pay attention to issues of equitable outcomes for student subgroups. The document is silent on issues pertaining to outcomes and equity gaps that may be revealed if data are disaggregated. Without student subgroup analysis it is nearly impossible to create an accurate picture of program performance overall or at the student subgroup level. What happens to diverse student groups should be an essential element of any evaluation of career pathways and programs of study.

A recent report on Perkins IV by Klein et al. (2014) reveals the current status of CTE education in the United States, including the implementation of programs of study aligned with career clusters and career pathways. Pointing to a lack of specificity in financing, implementation, and evaluation of CTE, Klein and his colleagues offered the discouraging finding that the implementation of programs of study (POS) is so diffuse and unregulated under Perkins IV that it is nearly impossible to paint a clear picture of what has happened with federal funding since 2006. With respect to

evaluation of student participation and outcomes, Klein et al. observed, “Lack of clear definitions on what constitutes a POS student and the absence of standardized reporting requirements related to POS further confound state implementation efforts. To date, relatively few state or local Perkins subgrantees are capable of providing accurate counts of the students who participate in POS or their outcomes” (pp. 233–234). This report suggests it is virtually impossible to know who participates in POS and to determine how students benefit from these programs. Recommendations of Klein et al. focus on improving program evaluation, although they fall short of specifying evaluation methods that enable states and local entities to assess whether outcomes are distributed equitably among student subgroups.

Also recently released, the Center for Law and Social Policy (CLASP; 2014) developed the Alliance for Quality Career Pathway (AQCP) Framework to assist states and local/regional entities to measure career pathway performance. Whereas career pathways are not synonymous with CTE, the focus on career preparation is sufficiently similar to suggest the CLASP Framework has relevance to the evaluation of CTE (Bragg, 2012). The AQCP Framework recommends a set of state, local/regional, and participant measures to evaluate the career-pathway trajectories of students by specifying criteria and indicators for state and local/regional systems, as well as participants. Though this model does not require that student outcomes be assessed at the subgroup level, it takes a modest step in this direction by stating that one of the goals of the framework is to “reduce racial and ethnic disparities” (p. 5). To its credit, this framework goes farther than any others to suggest that evaluating programs should contribute to closing equity gaps.

CTE Program Review

Attempting to understand state program approval and program review pertaining to CTE after passage of Perkins IV, Merkley and Johnston (2007) conducted a study of these state-level processes. Their study documented postsecondary CTE program outcomes required by Perkins IV, and they also identified inadequacies. For example, their study showed a lack of ability of state agencies to evaluate student achievement based on recognized industry standards and a limited capacity to measure job placement into high-skill, high-demand occupations. Their study also raised awareness of the federal government’s intension to raise the stakes on state agencies with authority to distribute federal dollars to local providers, including community colleges, documenting the challenges that states face under Perkins IV. Their study also raised questions about how new industry standards would be incorporated into program approval processes, how states would improve alignment between programs and employment, and how connections between secondary and postsecondary would be solidified.

Moreover, Merkley and Johnston documented CTE program review processes in 42 of the 50 states, noting that the frequency by which CTE programs required program review varied widely, from 1 to 10 years, with 4 years being the most typical time period. The indicators of program quality used by the states also varied widely but focused primarily on enrollment rates, graduation and completion rates, job placement rates, and program costs. They reported no evidence that state program review policies required or encouraged the disaggregation of outcomes by student subgroups, including special population groups. Thus, the state-endorsed program review policies focused on overall program performance, masking potential equity gaps in access, achievement, or outcomes between student subgroups.

These results provide an interesting yet troubling backdrop to recent findings of Klein et al. (2014) that point to little change to the national picture of CTE from the previous NAVE report (Silverberg et al., 2004). Klein et al. state, “With few exceptions, study analyses reproduced findings from the 2004 National Assessment of Vocational Education [NAVE] Final Report to Congress” (p. xxi). Finding lessened spending power due to inflation during the time Perkins IV was in effect, Klein et al. report reduced federal support for state and local programs that has resulted in diminished capacity for CTE. This finding, along with greater state discretion on the distribution of Perkins IV funds, may have lessened the impact of CTE programs overall.

To this point, there is surprisingly little description in Perkins IV and state policy about what program improvement means or how to do it relative to CTE. Among the vast array of evaluation methods presently used to measure and account for program quality, Levandowski (2014) argues that program review can be a useful tool for state boards, administrators, and trustees to apply to any program. Focusing his research on community colleges, Levandowski echoed an observation made more than 25 years ago by Glenny and Schmidlein (1983) who argued there are few areas of state government that are more controversial but potentially more important than program review. When this function is used to provide objective assessments of the conditions under which students learn, program review is very useful. Levandowski states, “Program review, when properly used, offers [state and local] decision-makers a tool for assessing the quality of community college programs and services” (2014, p. 2). Whether focused on CTE or other instructional programs, program review can help practitioners make decisions about program improvement by ensuring that results are regularly and routinely considered in campus and unit planning, decision making, and budgeting. His conception of program review endorses responsive, timely, and ongoing data collection for the purposes of improving any program that a community college offers. Knowing how all students are performing is a critical element of his formula for a successful program review.

Program Improvement in Illinois

Beginning in 2009, the Illinois Community College Board (ICCB) and the University of Illinois at Urbana-Champaign's Office of Community College Research and Leadership (OCCRL) partnered to create a program evaluation and continuous improvement process for career pathways and programs of study called Pathways to Results (PTR; Bragg & Bennett, 2012). Consistent with the state's guiding principles for implementation and evaluation of programs of study (see Taylor et al., 2009), PTR emerged as the community college system's preferred approach to program improvement. Using Perkins IV leadership funding, PTR was initially directed at programs of study but has expanded to include career pathways, adult and workforce education, and transfer education in a range of fields, including STEM.

Guiding principles for career pathways and programs of study provide a valuable way of framing implementation of the PTR process. The guiding principles seek practitioners to engage in (a) transformative leadership, with input from collaborative partners; (b) student access and engagement in programs and services; (c) alignment among education and training partners that facilitate student transition and transfer; (d) rigorous comprehensive curriculum, pedagogy, and career development that empower student learning, completion, and credential attainment; (e) professional development for instructional and administrative personnel to enhance student success; and (f) accountability and continuous program improvement to achieve equitable student education and employment outcomes.

Building on these guiding principles, PTR requires the commitment of individuals and groups, including partners, their team members, and students, who seek to ensure the success of all students by empowering their success and removing roadblocks that get in the way of their goal attainment (Bragg, McCambly, & Durham, 2016). Using student-level data to identify equity gaps in outcomes between racial, gender, low-income, and other underserved student groups, programs, along with processes and policies associated with those programs, are assessed to identify problems that impede the success of student groups. By gathering disaggregated data, concerns are defined, root causes are identified and analyzed, and plans are made to test solutions. To avoid focusing on deficits, exemplary cases are also identified and used as models to evaluate and spread improvements to other programs. In so doing, PTR provides a methodology to ensure that programs that produce equitable student outcomes are scaled to others.

Five critical processes for improving career pathways and programs of study are the focus of PTR, starting with (a) engagement and commitment of practitioners and partners, and continuing with (b) equity and outcomes assessment, (c) process assessment, (d) process improvement and evaluation, and (e) review and reflection. A brief description of these processes appears in Table 5.1. These processes are ordered in a way that makes sense for many PTR projects, but this order should be modified to fit local

Table 5.1 Pathways to Results Processes and Steps

<i>Process</i>	<i>Steps</i>
Engagement and Commitment	Engage leaders and form the partnership. Gather input from the partnership. Identify and convene the PTR team. Solidify the focus of the PTR improvement project using the charter.
Outcomes and Equity Assessment	Identify and select outcomes data and develop an understanding of equity. Engage institutional research staff in collecting and sharing data with the team. Review disaggregated student subgroup data from an equity perspective.
Process Assessment	Identify major processes (e.g., recruitment, assessment, instruction, advising, placement) that support student movement along a pathway and success in a program of study. Explain processes the team has selected for review, with a list of potential contributing factors to student subgroup results. Determine underlying reasons for problems, successes, and contributing factors.
Process Improvement and Evaluation	Identify solutions, also called process changes, and reach consensus on their implementation. Develop an implementation plan that includes a statement of goals, intended outcomes, roles and responsibilities, steps, timeline, cost, and resources. Develop an evaluation plan that includes goals, methods, and performance measures to evaluate the success of identified solutions.
Review and Reflection	Reflect individually on the PTR process by writing a brief reflective story about a significant idea, experience, or other aspect of the process. Meet as a group to reflect on what has been learned collectively about program improvement and student success. Come together create a group reflection that focuses on what can be sustained and scaled to other pathways and programs of study.

problems and needs. It is important for teams to jump into PTR at the point that makes sense for them, often either with the engagement and commitment process or outcomes and equity assessment. Where teams start may depend on the extent to which partners have been already engaged, or the extent to which student-level data are readily attainable to analyze student- and program-level performance.

The five PTR processes empower a team of practitioners and their partners to make meaningful improvements to programs, beginning with

Engagement and Commitment. This process focuses on engendering the involvement and support of individuals and organizations that are in the position (often also possessing the power and inclination) to facilitate program improvement. Believing that student success is facilitated by a broad-based, stakeholder approach, PTR requires the formation of a coalition of practitioners, including community college and other educators (e.g., Kindergarten through grade 12, adult, university), as well as students, employers, community leaders, and other stakeholders who understand that pathways to success are needed for all students.

Equity and outcomes assessment focuses on the systematic examination of disaggregated student data to identify problems with or barriers to programs that have the potential to serve student subgroups. This aspect of PTR is characterized by encouraging practitioners to be equity-minded in their examining of outcomes results (Dowd & Bensimon, 2014). As equity-minded practitioners, individuals recognize “deficit thinking” in the following passage from the PTR module on process assessment: “if we had better students, we would have better outcomes” (Harmon, Liss, & Umbricht, 2012, p. 3). As Harmon et al. note, the equity mindset that is encouraged by PTR asks practitioners to understand, “if we create better processes, our students will demonstrate better outcomes” (p. 3). This asset perspective turns deficit thinking on its head and dispels the notion that only some students are destined for success.

Process assessment allows PTR teams to investigate and document the nuanced processes that are integral to understanding how pathways and programs of study function. Using process mapping, practitioners determine how and why they fall short in enabling all student groups to achieve success. Process mapping points out gaps and inadequacies that impede student performance. Similarly, process mapping is used to document successful processes, identifying promising practices for adoption by other pathways and programs of study.

Process improvement and evaluation set into motion plans to implement, evaluate, and improve pathways and programs of study on a continuous basis. This phase of PTR is often already familiar to practitioners who are comfortable with planning new programs and excited to make changes. What is different here is that the decisions that practitioners make are grounded in data that guide their plans to reduce inequities between student subgroups, thereby raising performance for all learners. Changes that are made are not focused on what practitioners think might help but on evidence that shows how all students are performing.

Storytelling is a means of engaging practitioners in reflecting on what they are doing to improve programs and to support equitable student outcomes. Using the theory of double-loop learning (Argyris, 1993), PTR encourages storytelling that engenders deep understanding of what is working for diverse learners who are represented in pathways and programs of study. Discussion among practitioners who hold diverse perspectives,

including the stereotypes and biases that are ever-present in human sense-making, helps practitioners to “new ways of thinking about their students, which impacts the ways they carry out their everyday practice.”

After 6 years, PTR has been implemented in 46 of the 48 community colleges in Illinois, with over 80 projects completed or in process. PTR has also been extended to other community colleges in the United States that are recipients of Trade Adjustment Act Community College and Career Training Act (TAACCCT) grant funds wherein PTR is part of a comprehensive, mixed-method evaluation that includes performance, implementation, and impact evaluation. Also in Illinois, PTR is extending into the ICCB's program review process, including review of CTE and transfer education programs.

The program review system of the ICCB (2008) represents a major way to support campus-level planning and decision making and ensures the continuing need, improved quality, and cost-effectiveness of instructional programs. During 2014–15, the ICCB offered small grants to community colleges to integrate PTR into the program review process. Several colleges took the state's offer, building an earlier PTR project completed at Lincolnland Community College (personal communications with Wendy Howerter, 2014). In response to the call for proposals, Illinois Central College is integrating PTR into program review. According to this college's proposal, the PTR process is expected “bring in more partners, additional data, more perspectives examining the problems, additional tools and resources, and an overall strategy that will lead to action steps and improvements that could be addressed before the end of the year” (Dietrich & Sutton, 2014, p. 4). Through this project and others like it, the ICCB, in partnership with OCCRL, will formalize guidance for community colleges that seeks to use PTR in conjunction with program review. As a result of these efforts, Illinois' integration of program improvement and program review offer a valuable way to integrate equity and outcomes assessment into the core mission of the community college. Coming full circle, program review will be driven by outcomes and equity assessment that are necessary for program improvement to become a reality.

Implementations for the Future

Reflecting on past efforts to use PTR to bring about program improvement rooted in the examination of equitable outcomes, there are some important lessons for practitioners. First, CTE and STEM education program evaluation require thoughtful implementation and careful scrutiny. Past policies and practices that complicate or diminish the capacity of states and localities to implement program evaluation dedicated to improving pathways and programs of study need to be understood. Second, the necessity to gather student-level data that enables disaggregation of outcomes by student subgroups should be part of all continuous improvement,

program review, and accountability efforts. It is essential to understand whether outcomes are distributed equitably to diverse student groups, and to do otherwise makes no sense. Recognition that federal Perkins legislation has identified some student groups as “special populations” but neglected other groups, including racial and ethnic minorities, represents a problem for program evaluation. Third, the role that practitioners play in outcomes and equity work is critical if program improvement is to be impactful. It is advantageous to involve researchers and evaluators in program evaluation, but it is equally or possibly even more important to include practitioners in continuous program improvement processes such as PTR. This on-the-ground work is essential if pathways and programs in CTE and STEM are going to fulfill the needs of all of the nation’s diverse learners.

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